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AN INDEX OF PROGNOSIS
AND END-RESULTS OF TREATMENT

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AN
INDEX OF PROGNOSIS
AND
END-RESULTS OF TREATMENT

BY VARIOUS WRITERS

Edited by

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PREFACE TO THE THIRD EDITION

THE second edition of the *Index of Prognosis* came out whilst the editor and several contributors were overseas on active service, and a thorough revision was out of the question. It has therefore been necessary to effect a complete overhauling of this, the third edition, in order to keep pace with the remarkable advances that have been made since the book originally appeared in 1915. It is interesting and encouraging to observe that with the improvement in treatment the statistical end-results for several diseases are already showing more favourable figures, as may be seen by comparing the articles in the first edition with those in the following pages on, for instance, Epithelioma of the Lip, Strangulated Hernia, and Intussusception.

Most of the subjects dealt with have called for some revision, and in many cases that revision has been extensive and important. The section on Venereal Diseases has been re-written by Col. Harrison, and that on Gynæcology and Obstetrics by Dr. Eardley Holland. A new section on Ophthalmology has been contributed by Mr. Griffith. The present edition, therefore, puts its predecessors completely out of date; but no one can work over this field without coming to realize how much more we need to know about prognosis and end-results, and how the subject has been neglected. There are still conditions concerning which nothing has been published along the lines of this inquiry for many years.

A. RENDLE SHORT.
(*Editor.*)

October, 1922.



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PREFACE TO THE FIRST EDITION

THIS volume is issued as a companion to the *Index of Treatment* and *Index of Differential Diagnosis* brought out by the same publishers. Its principal aims are :

1. To set forth the results, and particularly the end-results, of various methods of treatment, in such a form as will enable the practitioner to obtain a fair, unbiased, reasoned opinion as to the prospects of securing for his patient permanent relief, and the risks of such treatment.

2. To furnish data by means of which, apart from the question of treatment, one may seek to arrive at an accurate forecast of what will probably happen to the individual patient.

Although the art of prognosis is vitally important—and nearly every intelligent patient, or his friends, will ask for an opinion as to his prospects, and will judge of the capacity of the medical attendant by the accuracy of that opinion—it is extraordinary to find how little help is given by current text-books. Especially is it difficult to find reliable data as to the end-results of treatment, more particularly surgical treatment. Even large monographs on special diseases, though they usually advise certain measures, only express a pious opinion as to the probable results thereof, unsupported by any trustworthy figures.

The compilation of the present *Index* has, therefore, been extremely laborious, because a painstaking search through the wilderness of modern medical literature in several languages has often yielded very small results. The editor has found it necessary to supplement the published records by investigating the end-results of treatment at the Bristol Royal Infirmary—upwards of a thousand patients having been communicated with for this purpose; and other contributors have also taken great trouble to acquire, from their private or hospital practice, the necessary figures.

The only way to express end-results in such a manner as to give authoritative guidance is by quoting statistics. Thus alone can the practitioner, unless his personal experience is far wider than ordinary, verify or qualify the promises of an enthusiastic specialist.

Published end-results have been calculated on various systems, and may be hopelessly unreliable. Sometimes, for instance, the cases are too few to warrant generalization. Very many figures are vitiated by too early reporting; patients with cancer, for example, having been followed up for a year or two only.

There are three principal classes of statistics: (1) Reports culled from the literature; (2) The records of individual surgeons; and (3) Studies of hospital cases published by registrars or others. Pickings from the literature are often absolutely misleading, because successes and curiosities have been selected for publication, while failures are unmentioned. The records of individual surgeons

are sometimes touched with *couleur de rose*. Hospital figures are the most reliable, but are usually less favourable than the results obtained in private practice, where patients are naturally better able to look after themselves.

Throughout this book, therefore, careful note is taken of the source of the information, and its relative value is taken into account in the summing up. We believe, moreover, it will be found that the figures are so presented that they do not unduly obtrude themselves, or confuse the plain and simple conclusions of the text which accompanies them.

Lastly, this volume is unique; nothing of similar character has appeared before or can compare with it. It therefore possesses a value entirely its own, and one which time will not diminish. Should it find sufficient favour with practitioners for further editions to be called for in the decades to come, the present compilation will yet maintain its position as a register of the progress of the healing art up to the time of its appearance—a date memorable in the world's history as that of the Great War.

It will be for the future to improve upon the end-results of the treatment here recorded, which at the time of writing have attained “thus far, but no farther”.

June, 1915.

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AN INDEX OF PROGNOSIS AND END-RESULTS OF TREATMENT

ABDOMINAL INJURIES.—We have to consider the consequence of (1) Blows on the abdomen ; (2) Punctured wounds. (*See also GUNSHOT WOUNDS.*) It will be necessary to set these forth according to the viscera which may be injured.

1. **Contusions.**—After a severe blow on the abdomen, the patient is usually seen within a few hours by a medical man, and the diagnosis and prognosis at first are often very difficult. Such injuries as a kick by a horse, buffer accidents, and cases where a vehicle has run over the abdomen, are always to be regarded as entailing very serious possibilities, because great force may have been localized upon a small area. It is extremely important to realize that the degree of shock when the patient is first seen is most misleading as a guide to diagnosis or prognosis. Thus, on the one hand, to take an extreme case, a powerful athlete may die outright as a result of a blow over the solar plexus, without any laceration of abdominal viscera whatever. An area the size of a half-crown is well known to pugilists as the 'mark', where a hard punch will induce instantaneous shock. If the injured person does not die at once, however, he will almost certainly recover completely, provided that the contusion of the abdomen has not ruptured any important viscera or vessels.

On the other hand, the prevalent impression that after the rupture of one of the important organs the patient's pulse will necessarily be quick and feeble, is misleading to the last degree, and many reputations have suffered because the doctor has seen a patient soon after the injury, and, trusting to the normal pulse and absence of shock, has sent him home with a good prognosis, whereas six hours later he was dying of internal hæmorrhage. Most hospitals have tragic stories to tell of this calamity. Ruptured spleen is particularly apt to lie hidden in this way. In a series of 15 cases of rupture of various abdominal viscera studied by the writer, in only 4 was the pulse over 100 when first seen, and these four all died within twenty-four hours.

It ought to be well recognized that prognosis is absolutely impossible within a few hours of a severe injury of the abdomen, unless, of course, the patient is already obviously dying. Even if there are no symptoms whatever, he ought to be put to bed and carefully watched, the pulse being counted every fifteen minutes for several hours. It is usually possible to recognize, when he is warm in bed, and has been given hot applications for the abdomen, that the condition remains or becomes favourable if no viscera are torn. Morphia, it is said, ought not to be given until the diagnosis is certain, as it masks symptoms. Probably, however, its influence in this direction has been exaggerated. The gunshot wounds of the abdomen we used to see in France at a casualty clearing station had all been given morphia, but this did not conceal the signs to any extent. There would seem to be no objection to a small dose if the pain is very great.

On the other hand, if important organs are torn, the condition will become worse, or at any rate there will be no improvement. Pain persisting more than six hours generally suggests a visceral injury ; so does localized deep tenderness. The pulse-rate often rises and its volume diminishes, the face becomes anxious, the patient, as we say, 'looks bad', and there is often rigidity of the abdominal wall. The temperature may be subnormal. Vomiting is fairly common, but not necessarily important ; even slight hæmatemesis may be of no serious import. A boy under the writer's care, although twice vomiting blood, recovered without further trouble. Evidence of free fluid in the abdomen, or the pallor and air-hunger of great hæmorrhage, are, of course, very grave signs. In ruptured spleen there may be fixed dullness in the left flank and shifting dullness in the right. Loss of

ABDOMINAL INJURIES

liver dullness is of no importance if the abdomen is distended, but may be a valuable sign of ruptured stomach or intestine if the abdomen is flat.

Such signs as the above are usually to be detected after watching the patient for four or five hours, and may of course, be evident much sooner. They urgently demand laparotomy.

One possible result of a blow on the abdomen well deserves notice. The writer has seen two cases illustrating it. After a contusion of the right iliac fossa, acute appendicitis may come on rapidly. In the first case, following a blow by a football, there was pain, tenderness, and rigidity, but the patient looked well, the pulse was normal, and he walked up to the hospital. The local signs were attributed to the blow the day before, and the lad was told to rest at home. Two days later he was admitted with appendicitis and general peritonitis, and died. In the second case, the condition when first seen was exactly similar, but the temperature was taken, and found to be raised. This boy was operated on, and recovered well. The temperature is the clue to these very deceiving cases.

Ruptured Intestine.—We are greatly indebted to the careful study of Berry and Giuseppe on 132 cases, being the total number treated in ten London hospitals from 1893 to 1907. Berry has recently added another series of 44 cases from twelve London hospitals (1908–1912). The writer has been able to trace 8 more treated at the Bristol Royal Infirmary (1900–1921).

TRAUMATIC RUPTURE OF INTESTINES.

	WITHOUT OPERATION			WITH OPERATION		
	Cases	Died	Recovered	Cases	Died	Recovered
10 London Hospitals, 1893–1907	48	44	4 = 8%	84	67	17 = 20%
12 London Hospitals, 1908–1912	14			30	21	9 = 30%
Bristol Royal Infirmary	1	1	0	7	1	6

Many of the patients, of course, were admitted moribund, or had fractured pelvis or spine. Apart from operation, death usually ensued within twenty-four hours; one patient lived ten days.

The best results were obtained by early operation, which means within twelve hours. All the Bristol successes were treated from four to six hours after injury; of the earlier London cases, 13 out of 33 operated on within twelve hours recovered, but only 1 after the lapse of twenty-four hours.

As regards the site of the injury, duodenal tears were almost invariably fatal.

It will be observed that, even apart from operation, 4 cases recovered in which abscesses or obstruction, developing subsequently, showed that rupture had occurred. One patient who was thought too ill to have anything done got well without operation!

After successful suture, the great majority of the cases seem to remain quite well. Of the Bristol cases, 3 were examined long afterwards, and had no trouble except a slight incisional hernia in 1 case; 2 of these were seen by the writer six and eight years after the operation. A few of the London cases returned for obstruction or abscesses.

Ruptured Liver.—Recent data concerning this injury are not easy to obtain. The writer has abstracted the records of 12 cases treated at the Bristol Royal Infirmary, of whom 8 were operated on and 3 recovered. One of the latter had a small tear, and was not diagnosed for two days.

Adding together the statistics during ten years in the Bristol series, and five years at St. Thomas's and the Middlesex Hospitals, one obtains a record of 20 cases operated on, of which 13 died and 7 recovered.

Tilton reports the figures from ten New York hospitals during 1895 to 1905, whereof 7 out of 12 died and 5 recovered.

Ruptured Spleen.—This injury is particularly apt to be misleading when first seen. The dangerous tendency to produce no alarming symptoms for several hours has already been mentioned.

Laspeyres has found in the literature 58 cases of splenectomy for rupture, of which 39, or 67·2 per cent, recovered ; but such records are likely to be far too favourable, as deaths are less written up than successes.

Putting together the figures for the Bristol Royal Infirmary and St. Thomas's and the Middlesex Hospitals, one finds 19 cases with 10 deaths and 9 recoveries. Of the last 4 cases in Bristol, 3 have recovered.

Ruptured Pancreas.—This appears to be a rare injury ; two large London hospitals had no case in five years. At the Bristol Royal Infirmary there have been 2 recent cases ; 1 died, the other recovered, and was well four years later. The fatal case furnishes an instance of a common sequel, namely, severe self-digestion of the tissues leading to subphrenic abscess. Mikulicz in 1903 collected from the literature 24 cases, of which 13 died without operation, and of the 11 operated on 7 were cured.

Pancreatic cyst has followed injury of this gland.

Ruptured Kidney.—Beall has given to us several tables of statistics collected from the literature and from hospital reports jointly, and therefore probably rather too favourable. Probably the same cases are included in several of the lists. The most useful figures are those of Delbet and Watson, which are as follows. It will be observed that of cases not operated on about two-thirds recover, of those submitted to nephrectomy about three-quarters, and all but about 5 per cent of those explored but found not to need removal of the kidney.

	NO OPERATION			NEPHROTOMY			NEPHRECTOMY		
	Cases	Died	Per cent	Cases	Died	Per cent	Cases	Died	Per cent
Delbet	225	103	45	50	2	4	44	11	25
Watson	273	81	30	99	7	7	115	25	22

When the only evidence is a transient hæmaturia, the patients make a perfect and complete recovery. When there is in addition a swelling in the loin, but no tear of the ureter and no early shock or hæmorrhage, the outlook is good. Three cases, seen by the writer many years afterwards, had continued quite well.

Marked signs of shock make a bad prognosis, whether the effusion of blood is into the loin or into the peritoneum. Two such cases at the Bristol Royal Infirmary treated by nephrectomy both died. Laceration of the renal pelvis or ureter leads to leakage of urine or hydronephrosis, which may suppurate, when the outlook becomes very grave. The outlook in children is serious ; according to Maas, 85 per cent die.

Rupture of Bladder.—This is not very common. Two large London hospitals had no cases in five years. Of 8 cases at the Bristol Royal Infirmary, only 2 recovered, but usually the operation was undertaken too late to give the patient a chance. There can be no doubt that if there are not severe injuries besides, and no cystitis is present, early diagnosis would save a larger proportion. One man fell into a ditch whilst intoxicated, and ruptured his bladder into the peritoneum. He was treated by a doctor in the country for a week ; sometimes he passed water himself, and sometimes a catheter was used. He was up and about most of the time. On admission, the abdomen was greatly distended ; at the operation, 13 pints of urinous fluid were evacuated, and twelve sutures were necessary to sew up the rent in the bladder. He died, but could no doubt have been saved by earlier operation.

Collections of isolated cases from the literature, such as Quick's and Ashhurst's, are unreliable in estimating the true mortality, as fatal cases so often fail to get into print. The latter reports 22 cures out of 29 cases operated on by various writers since 1893.

2. Perforating Wounds.—It is not possible to say much about the prognosis of stab wounds of abdominal viscera, because so much depends upon the circumstances and upon early operation. Given prompt diagnosis and treatment, the majority of the cases ought to recover, just as a perforated gastric ulcer usually does ; but a few hours' delay, at any rate beyond twelve hours, will seriously jeopardize the patient's chances. When the signs of widespread peritonitis are present, the outlook is very grave, but by no means hopeless.

Statistics are not easy to obtain. Tilton reports that of 13 cases of stab or shot wound of the liver from ten New York hospitals, 4 died and 9 recovered. The prognosis is, of course, much better than that of contusion.

Probably all the figures given throughout this article, for each of the viscera, are less favourable than would be obtained by present-day surgery. Of 22 cases of traumatic rupture of the abdominal viscera at the Bristol Royal Infirmary from 1900 to 1912, only 9 recovered, but from 1913 to 1920, 7 out of 11 were saved by operation.

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A. Rendle Short.

ABSCCESS.—(See AMEBIC LIVER ABSCESS; PSOAS ABSCESS; SUBPHRENIC ABSCESS; ETC.)

ACCESSORY SINUSITIS.—(See NASAL ACCESSORY SINUSITIS.)

ACIDOSIS.—The prognosis of acidosis depends more on its cause than on its intensity, though, *cæteris paribus*, the degree of the latter is a most important item. The most common conditions in which it occurs are diabetes mellitus, starvation, sudden withdrawal of carbohydrate food, after some anæsthetics, during febrile diseases, in the toxæmic vomiting of pregnancy, the cyclic vomiting of children, and in phosphorus poisoning. Although many factors, including the administration of mineral acids, may lead to diminished alkalinity of the juices of the body, and so cause a state of acidosis, here we are not referring to such conditions, but to an acid intoxication set up by the presence of β -oxybutyric acid, diacetic acid, and acetone. To this form of poisoning children are more susceptible than women, and the prognosis is worse in children than in women. Similarly the outlook is worse in women than in men. These substances not only exert a direct toxic effect on the tissues of the body, but also act detrimentally on account of their acid properties. In severe cases they are excreted in very large quantities, and this represents a large quantity of unused fuel, entailing a considerable loss of energy to the body. For purposes of prognosis it is necessary not only to determine the presence of acidosis, but also, so far as is possible, the degree of acid intoxication. By the usual tests the presence of these substances will be proved in the urine. Probably also the odour of acetone in the breath will be obvious.

T. Stuart Hart, in the *Quarterly Journal of Medicine*, has given the following method for estimating the acidosis index. He first demonstrates the presence of acetone by the usual test (Lange's). Secondly he employs the ferric chloride method (Gerhardt's test) to show the presence of diacetic acid. He uses the following solutions for the determination of the acidosis index:—

a. The 'standard solution', consisting of ethyl aceto-acetate 1 c.c., alcohol 25 c.c., and distilled water to 1000 c.c.

b. Ferric chloride solution, consisting of 100 gm. of ferric chloride dissolved in 100 c.c. of distilled water.

An equal quantity (10 c.c.) of (a) and of the urine to be tested is put into two test-tubes separately. To each of these 1 c.c. of (b) is added. After waiting a few minutes, the intensity of the colour of the two is compared. If the solution in the (a) test-tube is lighter than the urinary solution, add known quantities of distilled water to the latter till the shade of the two is the same. From the figures so obtained the 'acidosis index per litre' is arrived at.

Thus:—

Lange's test positive and Gerhardt's test negative	=	Acidosis index per litre 0.5
Lange's test positive and Gerhardt's test positive		
Volume of urine solution 10 c.c.	=	1
" " " 20 "	=	2
" " " 100 "	=	10
and so on in proportion.		

To obtain the 'acidosis index', the 'acidosis index per litre' is multiplied by the amount of urine in litres passed in twenty-four hours.

This method gives an 'acidosis index' which can be translated in terms of β -oxybutyric acid. Thus an acidosis index of 10 is equivalent to the daily excretion of 10 gm. of β -oxybutyric acid.

Another helpful test is the reaction of the patient's urine to alkali given by the mouth—e.g., a patient who requires more than 1 oz. a day of sodium bicarbonate to make his urine alkaline is suffering from acidosis of very considerable severity. In a healthy individual 2 drachms of sodium bicarbonate will keep the urine alkaline for twenty-four hours. If, however, an excess of acid is being formed in the body, the soda will unite with the acid radicles, and be excreted in the form of neutral salts, and thus fail to make the urine alkaline. The amount of sodium bicarbonate required to be given to induce alkalinity helps materially therefore in forming a prognosis.

The reduction in the alkalinity of the blood will also give valuable indications, for if this is reduced, it is almost certain that the rest of the tissues have suffered to a greater degree. The methods most frequently used at the bedside for the estimation of the intensity of acidosis are the measurement of the alveolar carbon dioxide, and estimation of the percentage of nitrogen excreted in the form of ammonia compared with the total excretion of nitrogen, the so-called 'ammonia index'. With regard to the former, the hydrogen-ion concentration of the blood may remain constant, even when there are more acid radicles present in it, by a diminution of the carbon-dioxide content of the blood. This condition is called 'compensated acidosis'. The respiratory centre is probably very sensitive to small additions of acid to the blood, and tends to maintain the normal reaction of the blood by a fall in the alveolar CO_2 . The estimation of the carbon dioxide in the alveolar air may be estimated rapidly at the bedside by the Fredericia apparatus. The ammonia nitrogen in health is at most about 5 per cent of the urinary nitrogen, but in conditions of acidosis it not infrequently rises to 18 to 20 per cent, and readings as high as 40, 50, or even 60 per cent have been recorded.

The nitrogen is apparently excreted in the form of ammonium salts, instead of being built up in the body into urea, in order to neutralize the condition of acidosis in the tissues and to save the mineral bases of the body.

It must not, however, be assumed that acid intoxication exists because the percentage of ammonia nitrogen excreted in the urine is very greatly increased; for this proportion may be raised, not because there is any absolute increase in the amount of ammonia nitrogen, but because there is an absolute decrease in the amount of urea excreted. This not infrequently happens in conditions of protein or total starvation. It has been found that when the urea excretion falls below 7 to 8 gm. in the twenty-four hours, the relative percentage of ammonia nitrogen increases, and that this may occur apart from the presence of organic acids. An absolute as well as a relative increase in the output of ammonia nitrogen must be looked for, if this is to be used as a basis of prognosis. As much as 12 gm. of ammonia nitrogen have been observed to have been excreted in twenty-four hours, being 40 per cent of the total nitrogen excreted.

The total quantity of ammonia excreted forms an indication of the degree of acid intoxication, but not necessarily of the amount of organic acid being simultaneously excreted. For the estimation of this, the test of Hart, mentioned above, forms a very useful guide.

It is of the greatest value to make constant observations on the percentage of the ammonia-nitrogen excretion in any given case, to ascertain the presence of increasing danger; but the figures so obtained are of little value in comparing one patient with another, for a man may be in fairly good health who is excreting a much greater amount of ammonia nitrogen than one who is in diabetic coma. There appears to be little doubt that acid intoxication is responsible for the coma and other toxic symptoms in diabetes, and kills the patient; but the excretion of acetone bodies may go on for many months without acid intoxication supervening.

Marked diminution in the alveolar CO_2 and increase in the ammonia index are, however, signs of very serious significance.

In starvation, the condition is different, because, in spite of the fact that the patient suffers from acidosis, he can still assimilate and use carbohydrates if he can get them, and as he still possesses the power of utilizing cleavage carbohydrate derived from his own tissues, he probably dies rather from actual deprivation of food than from acid

intoxication, a point which makes the outlook, as far as treatment is concerned, much more hopeful than in the corresponding state of diabetes.

In post-anæsthetic poisoning, it must be remembered that the patients have generally been starved, and that in starvation the total excretion of ammonia is to be estimated, not merely the percentage of the ammonia nitrogen, as this may appear unduly high, owing to the small amount of urea excreted. The prognosis is much improved if treatment with sodium bicarbonate and glucose is used before the administration of the anæsthetic. Glucose seems to be more effective than the alkali in preventing post-anæsthetic vomiting. (*See ANÆSTHETICS, p. 38*).

It is probable that in severe cases of uræmia, associated with marked dyspnœa, there is an 'uncompensated' acidosis, and that a similar condition may also occur in the later stages of cardiac dyspnœa. In each of these conditions the prognosis is exceedingly grave.

In diabetes (*see article*) the prognosis in the earlier stages of acidosis has been much improved in recent years by new methods of treatment.

When acidosis is present and diacetic acid excreted, it is said to be a favourable sign if the output of diacetic acid increases after the administration of sodium bicarbonate. This is explained on the assumption that the base unites with the acid and enables the acid to be excreted in larger amounts.

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ACROMEGALY.—We now believe that this disease is caused by an excess of secretion of the anterior lobe of the pituitary gland, and in many cases it is found that the sella turcica shows enlargement in the skiagram, and at the autopsy the gland is usually much increased in size. If the symptoms of hyperpituitism come on before the epiphyses of the long bones have united, gigantism results. We have to consider first, the natural prognosis, and then the effect of operation. In the great majority of cases there is no immediate danger to life, and the patient may not even be reduced to invalidism. The profession is much indebted to Dr. Mark for the graphic description he has given us of his own case. The principal troubles are likely to be neuralgic pains, protrusion of the lower jaw interfering with eating, and limitation of the field of vision by pressure on the optic chiasma. In other cases, symptoms of hypopituitism follow, possibly due to deficiency of the posterior lobe, leading to impotence in the male and amenorrhœa and sterility in the female. The subjects of gigantism are generally feeble, and seldom live to a great age.

There are cases, however, in which the outlook becomes unfavourable owing to further increase in the size of the gland leading to intracranial pressure. This is much commoner in the converse condition of hypopituitism (Fröhlich's type) characterized by adiposity and atrophy of the genitals; these patients are often suffering from a sarcomatous or cystic growth. When, therefore, in cases either of acromegaly, gigantism, or Fröhlich's type, the patient complains of continuous severe headache, vomiting, and progressive blindness, which are found to be associated with slow pulse and optic neuritis or atrophy, it is probable that death is not far off. The cases of hypopituitism are more ominous than those of acromegaly.

Prognosis of Operation.—The operation mortality is not so high as one might suppose from the inaccessible situation of the gland. Von Eiselsberg reports 16 cases with 4 deaths (from acute meningitis). Cushing avoids opening the nasal sinuses so as to reduce the risk of sepsis, and has only lost 10 per cent out of 61 operations; several of the patients were already desperately ill. The purpose of the operation was to relieve pressure by decompression, the base of the pituitary fossa being removed; in other cases, part of the gland was excised, or a cyst evacuated. If the signs of intracranial pressure are marked and generalized, a subtemporal decompression gives more relief.

With reference to the eventual results, von Eiselsberg claims that all his recovered cases were greatly relieved of their headache and amaurosis; he followed some of them as long as four years afterwards.

Cushing records improvement in half of his cases. Both observers remark that the bony enlargements of acromegaly may show reduction.

Glandular feeding does no good in acromegaly and gigantism. In cases of the Fröhlich type, feeding or injection is occasionally followed by remarkable benefit.

REFERENCES.—Cushing, *Pituitary Body and its Disorders*; von Eiselsberg, *Arch. f. klin. Chir.* 1912, Dec. 8.

A. Rendle Short.

ACTINOMYCOSIS.—It is probable that under this clinical term various forms of streptothricosis are also included, but it is not clear that there is any marked difference in behaviour.

The prognosis depends principally upon two factors: the location of the disease, and the degree of septic infection which has supervened. To some extent also the nature of the treatment controls the end-result. Colebrook advocates the use of a vaccine, and in his cases quoted below this was used. He also makes a point of cleaning out the abscesses with a gauze swab and not a sharp spoon.

Actinomycosis of the Appendix and Cæcum.—This forms a fairly well-defined clinical group, of which the writer has seen 6 cases, and reported 2 more, in the wards of the Bristol Royal Infirmary. Up to 1907 there were about 150 cases in the literature, of which 27 were British, but it is certain that the real frequency is much greater. In about 60 per cent of cases of abdominal actinomycosis this region is affected. The outlook is very grave. Grill reported 77 cases, whereof 22 were said to be cured, 10 relieved, and 45 died; but it is probable that this estimate is too favourable, in that the cases were not followed long enough. Patients of Gangolphe, Waring, and Blascko, and 2 seen by the writer, were apparently cured or relieved for months or years, but the disease returned, in one of the writer's cases after eight years, and death resulted. There are, however, a few authentic cures. The eight Bristol cases all died.

Colebrook reports 6 cases from St. Mary's Hospital; 1 recovered and 5 died.

The course of the illness is miserably chronic in the majority of cases, though some have died in a few weeks or months. Beginning like an ordinary appendicitis, or occasionally with attacks of diarrhoea, a huge resistant mass gradually forms in the right iliac fossa, and abscesses open and burst through the skin. The pain is not great. By degrees the fungus spreads over the whole abdomen, metastases appear in or about the liver, and usually death from septic absorption follows in about nine to twelve months. By this time abscesses may have opened into the bowel, bladder, or other organs, producing faecal or urinary fistulae.

Abdominal Actinomycosis in other Localities.—Next to the right iliac fossa, the ray-fungus most commonly affects the liver, and may come through the chest wall, as in a case seen by the writer. Almost any other organ in the abdomen may be affected, but rather uncommonly.

The prognosis is unfavourable, but not hopeless. Jiron (quoted by Keen) gives the death-rate in abdominal actinomycosis as 71 per cent, which is probably too flattering, as figures taken haphazard from the literature are apt to be.

Actinomycosis of the Face, Jaw, and Tongue.—This is a common location, and a relatively favourable one if the diagnosis is made reasonably early. Huge swelling, with much induration but little pus, fixed to the jaw (usually the lower), but extending widely into the cheek or tongue, with a tendency to form sinuses, characterizes the disease. Given efficient treatment, however, it can usually be controlled, though it will be months before the patient is well again.

Jiron quotes the mortality in this situation as 11 per cent; here again the figure is probably too favourable. At St. Mary's Hospital there were 10 cases, of which 9 got well and 1 died (Colebrook).

Pulmonary Actinomycosis.—The fungus may attack the lungs, or appear in the chest wall, forming a spongy abscess. In either case the outlook is very grave. Hodenpyl collected 34 cases, of which 32 died. The duration of life is about six to twelve months.

Jiron reports that cases from the literature show a mortality of 83 per cent in thoracic cases. Of 8 cases at St. Mary's, 7 died and 1 was lost sight of.

Actinomycosis of the Brain.—This is rare, and appears to be rapidly fatal.

Actinomycosis of the Skin.—This is a favourable location, and though it may be very chronic, the considerable majority of the cases, if treated, are eventually cured. In Colebrook's series there was a patient with infection of the back of the hand, who got well.

The Effect of Treatment.—The outlook is most favourable, of course, in situations where a radical removal can be undertaken, but actinomycosis of the appendix has several times recurred in the stump.

Potassium iodide in large doses (240 gr. a day for months at a time) probably

exerts a real curative effect, and the United States Commission reported that it cured 63 per cent of cases in cattle. Copper salts, which are very poisonous to algæ and moulds, are recommended both locally and by mouth, but statistics are not available. The best results are obtained by a combination of these methods with surgery.

REFERENCES.—*Keen's Surgery*, vol. i, article "Actinomycosis"; Jiron (reference not found : incorrectly given by Keen); A. Rendle Short, *Lancet*, 1907, ii, 760; Colebrook, *Lancet*, 1921, i, 803.
A. Rendle Short.

ADDISON'S DISEASE.—In gauging the influence of treatment in Addison's disease, it must be borne in mind that periods of improvement occur spontaneously, and may be erroneously explained as due to therapeutic measures. In this connection the generally admitted difficulty in foretelling a successful response to treatment in a given case is significant. Further, as in other grave organic diseases, the inauguration of treatment is often followed by transient improvement, due more to auto-suggestion than to any specific action of the drug.

General Treatment.—The avoidance of fatigue and worry is always essential, and in advanced stages absolute rest in bed is most important, to prevent sudden fatal syncope. A patient whom I saw with characteristic symptoms survived for ten years, but was in bed for the last eight years. Although open-air treatment has done good, and is reasonable on the ground that most of the cases show tuberculosis of the adrenals, protection from cold and exposure must be insured. Healthy and cheerful surroundings, with sun and warmth, by improving the general health and resistance, have an obvious bearing on the prognosis. In a few instances, of which Gaucher and Gougerot¹ have collected six examples, syphilis appears to be the causal factor, and in these circumstances it is reasonable to hope that improvement will follow careful antisiphilitic medication; but these patients bear mercury badly, and the administration of salvarsan preparations would be an anxious proceeding.

Organotherapy in this disease is very disappointing as compared with the results in myxœdema. A small proportion of cases are permanently benefited or cured, marked improvement occurs in some instances, and that there is some relation between the two is borne out by the onset of relapses when the treatment is stopped, and by improvement when it is resumed; on the other hand, relapses and even death may occur during treatment. In nearly half the reported cases, treatment does not exert any influence, and in a few instances alarming symptoms appear to be due to administration of suprarenal products. That arterial lesions comparable with those produced experimentally may be caused in Addison's disease by adrenal medication is unlikely, though Loeper and Crouzon² report a case bearing this interpretation. Adams's³ critical analysis of 112 collected cases of Addison's disease treated by suprarenal medication shows that in 6, or 5·35 per cent, permanent benefit or cure resulted; in 33, or 29·5 per cent, marked improvement followed; in 49, or 43·75 per cent, no effect was noted; and in 7, or 6·25 per cent, alarming symptoms were due to the treatment.

Tuberculin Treatment.—Although cases thus treated may undoubtedly improve or appear to be almost cured, as in Munro's⁴ patient whom I saw, it must be remembered that even small doses of tuberculin may cause alarming symptoms, and probably for this reason the number of reported cases is very small. The prognosis in cases thus treated is complicated by the difficulty of determining that a given case is due to adrenal tuberculosis. Cases of tuberculous disease of the adrenals may fail to show any improvement after tuberculin.

Operative Treatment would appear to be entirely contra-indicated by the high grade of asthenia characteristic of the fully-developed disease, and has only been attempted in isolated cases. A tuberculous adrenal which formed a palpable tumour was removed from a woman with the constitutional signs but without the pigmentation of the disease, and recovery followed (Oestreich⁵). Transplantation of an animal's adrenal into the testis of a patient with Addison's disease was carried out by Busch and Wright,⁶ who reported some improvement; but death occurred two and a half weeks after the operation. Dr. A. F. Hurst has told me of a case into which the adrenals from a recent necropsy were transplanted, but too late to have any good effect.

Prognosis in Individual Cases.—Addison's disease, when so well established that it

can be confidently diagnosed, appears to be almost always fatal sooner or later ; but it is well known that very considerable lesions of the suprarenals may be entirely latent until, as the result of some acute infection or intoxication falling on the adrenals, acute inadequacy occurs and leads to a fatal termination. Sergent⁷ insists with some reason that such cases should not be included in Addison's disease, but be entitled 'acute adrenal inadequacy'. Further, some degree of suprarenal inadequacy or 'Addisonism', especially in chronic pulmonary tuberculosis, in which the symptoms suggest but fall short of those in Addison's disease, may be a temporary condition (Boinet⁸). The diagnosis in the early stages is difficult, and the possibility of error must be frankly admitted, for cases diagnosed by thoroughly competent physicians may recover and remain perfectly well. Thus, I know a distinguished physician who was diagnosed as a case of Addison's disease by Greenhow, a well-known authority on the disease, more than forty years ago, and who was a great athlete and is now a grandfather in perfect health. Out of 293 cases collected by Lewin⁹ in 1892, cure was stated to have occurred in ten. It is therefore probable that arrest may occur after initial symptoms of slight intensity have been noticed.

The average duration of symptoms in Wilks's¹⁰ cases was eighteen months, but some of these cases ran a very acute course. On the other hand, survival for ten or even more years after the onset of symptoms has been recorded. The most acute cases are those in which the suprarenals are already damaged, usually by tuberculous infiltration, but in which symptoms are absent until, as the result of some acute infection or toxæmia, the available chromaffin substance is paralyzed, so that symptoms burst out in a fulminating manner, leading to death in a few days or weeks. As already pointed out, these cases are not, strictly speaking, examples of Addison's syndrome. Between the very chronic and the fulminating cases there are intermediate groups which contain most of the cases. Cases of simple atrophy of the adrenals appear to run a more rapid course than the more usual cases in which the glands are invaded by tuberculosis. Possibly this is because there is atrophy of the whole chromaffin system, which thus prevents any compensatory hypertrophy.

Pigmentation, which usually suggests the diagnosis, is much less important than asthenia as a guide to the course of the disease ; in fact, the most acute cases are commonly free from bronzing. Ramond and François¹¹ believe that in some cases (4 out of 26) of Addison's disease the thyroid acts in such a compensatory manner that indications of hyperthyroidism appear, and that in these cases the prognosis is better ; they therefore advise thyroid as well as adrenin medication in all cases of Addison's disease, and report very definite improvement in 3 out of the 22 cases which did not show signs of hyperthyroidism. I am familiar with cases reputed to show a combination of Addison's and Graves' diseases, but had regarded them as solely Graves' disease. In children, the disease is both rarer and runs a more rapid course than in adults ; it is said that two-thirds of the cases in children last less than a year (Castaigne and Simon¹²). The outlook is obviously worse in cases which steadily progress downhill than in those which have periods of remission.

Danger Signals.—Great asthenia and collapse, excessively subnormal temperature, yawning, low arterial blood-pressure (e.g., a systolic blood-pressure of 65 mm. Hg), and disappearance of the radial pulse, point to imminent dissolution. I have twice found the radial pulse absent, and in both instances death followed within thirty-six hours. Severe vomiting and diarrhœa, and acute abdominal crises which may imitate appendicitis, are also grave signs. The onset of acute infections, such as influenza or pneumonia, makes the outlook almost hopeless. A high differential count of lymphocytes has been regarded as an unfavourable sign ; this is probably because it points to the co-existence of the status lymphaticus which favours sudden syncope or death.

REFERENCES.—¹Gaucher et Gougerot, *Ann. des mal. vén.*, Paris, 1911, xvi, 321 ; ²Loeper et Crouzon, *Bull. Soc. Anat.*, Paris, 1903, s. 6, v, 918 ; ³Adams, *Practitioner*, 1903, lxxi, 472 ; ⁴Munro, *Brit. Med. Jour.*, 1912, i, 665 ; ⁵Oestreich, *Zeits. f. klin. Med.*, Berlin, 1897, xxxi, 123 ; ⁶Busch and Wright, *Arch. Internal Med.*, Chicago, 1910, v, 30 ; ⁷Sergent, E., *Etudes cliniques sur l'Insuffisance Surrénale*, 1898-14, Paris ; ⁸Boinet, *Rev. de méd.*, Paris, 1897, xvii, 136 ; ⁹Lewin, *Charité Ann.*, Berlin, 1892, xvii, 536 ; ¹⁰Wilks, S., *System of Medicine* (Reynolds), 1879, v, 359 ; ¹¹Ramond et François, *Bull. et Mém. Soc. méd. des Hôp. de Paris*, 1917, 3^e sér., xli, 1131 ; ¹²Castaigne et Simon, *La Pratique des Maladies des Enfants*, 1910, iii, 307.

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ALBUMINURIA. (*See also NEPHRITIS.*)—The question of prognosis when albuminuria is present must, in the first place, depend entirely on accurate diagnosis. Albuminuria may result from contamination of the urine by an albuminous liquid, such as blood, pus, or spermatic fluid. Such albuminuria is spoken of as spurious, false, or accidental albuminuria, and should be sharply differentiated from true albuminuria, where the albumin enters the urine from the glomeruli or uriniferous tubules. The differentiation between spurious and true albuminuria does not, as a rule, present any great difficulties, for a contaminating fluid usually contains a very large number of cell elements, which form a sediment on standing, leaving a clear supernatant fluid which contains but a small proportion of albumin. Again, microscopic examination of the sediment will aid differentiation; and tissue elements may be present which do not belong to the urine. The occurrence of true pus-cells in large numbers points to an inflammatory affection of the urinary passages; for though polymorphonuclear leucocytes are found in the sediment of a nephritic urine, they are never present in large numbers. When a diffused nephritis occurs in combination with an inflammatory affection of the urinary passages, the supernatant urine will contain a large proportion of albumin. When false albuminuria is present in association with a chronic interstitial nephritis, the proportion of albumin in the supernatant fluid may be small, and diagnosis may present difficulties: consideration of the total quantity of urine, and the condition of the cardiovascular system, together with estimation of the blood-pressure, will always give valuable data for guidance in diagnosis.

Physiological Albuminuria.—There can be no doubt that, if the tests used be sufficiently sensitive and delicate, albumin can be demonstrated in a large number of normal urines; and it is now held that, though albumin cannot be demonstrated in every healthy urine, yet, under physiological conditions—conditions quite within the limits of health—it may appear in such quantity as to be easily demonstrable by ordinary tests. This form of albuminuria occurs in healthy individuals *before* middle life, at intervals, and *only in response to some definite stimulus or strain*, such as a heavy meal, unusual exertion, cold bathing, mental excitement, etc. If the urine be examined with the centrifuge, a few hyaline casts and cylindroids will be found, but no epithelial or granular casts. The albuminuria in such cases has no definite pathological significance, and the prognosis is good. Take, for instance, the athlete at the commencement of training: exertion may produce albuminuria, but as training proceeds, similar exertion may no longer produce it.

Cyclical Albuminuria is distinguished from the physiological variety by the fact that no special exciting factor is required for its production, and the condition cannot truly be considered physiological. It occurs in young persons, who are frequently of poor nutrition and with a somewhat defective, atonic digestion. The urine shows a fairly high specific gravity, easily deposits urates, and contains albumin. The latter follows a recognized cycle: on rising, the urine is free from albumin; but it appears during the morning hours; it reaches a maximum in the early afternoon; and it diminishes in the evening. The centrifuged deposit may show a few hyaline, but never epithelial, casts. Cardiovascular changes are entirely absent, and the blood-pressure is not above the normal. In these cases the prognosis is favourable. The patients are somewhat weakly individuals, whose digestion requires care and attention, but they do not ultimately develop nephritis. Under care they may, and do, enjoy good health; though the albuminuria may persist for years, it ultimately disappears, and the expectation of life seems unaffected by the condition.

Febrile Albuminuria.—During an acute infectious disease, it is common to get a small quantity of albumin in a urine which, otherwise, does not give the characters of a nephritic urine. It is possible that, in such cases, circulatory disturbances may come into play; but the main causal factor is cloudy swelling resulting from infection and intoxication. Strictly speaking, such an albuminuria must be regarded as the first stage of an infectious nephritis, which may or may not develop into a definite nephritis. The presence of the albuminuria shows that the fever has had a marked effect on the organism. The general condition of the patient is often serious: the temperature is high, the pulse frequent, and dyspnoea and collapse may supervene. Most of these symptoms are, however, dependent upon the general disease, and not upon the renal disturbance.

Prognosis will, therefore, be governed by the general condition. The albuminuria is merely an expression of the profound nature of the general disturbance, which has given rise to cloudy swelling of the tubular epithelium. In the large majority of cases, febrile albuminuria does not develop into definite nephritis, but disappears with improvement in the general condition.

Albuminuria of Non-febrile General Disease is found, especially, in diseased conditions involving the blood, such as anæmia, leukæmia, scorbutus, and jaundice. The albuminuria, in such conditions, is largely to be accounted for by the blood condition and the circulatory disturbances which so often accompany the primary disease. It is true that, in a certain number of cases, epithelial changes have been found in the kidneys; but these are by no means constant. As a rule, prognosis will be guided by the general condition of the patient. The albuminuria is an expression of profound disturbance, and will, therefore, be a factor to be taken into consideration in guiding prognosis.

Albuminuria occurring in the course of diabetes mellitus seems to stand in a different category. It has been ascribed to the excessive ingestion of eggs; but, in the majority of cases, it is the expression of an insidious nephritis of the interstitial variety, and the patients, for the most part past middle life, show cardiovascular changes. The question of prognosis is a mixed one; for when interstitial nephritis develops in the course of diabetes, amelioration may take place in the diabetic symptoms and glycosuria may disappear. The prognosis then becomes that of chronic interstitial nephritis complicated with hyperglycæmia; that is to say, it is always grave.

Albuminuria due to Circulatory Disturbances is common in cases of cardiac disease with loss of compensation and passive congestion of the kidneys. In these cases, imperfect circulation leads to deficient oxidation and secondary changes in the renal epithelium. An additional causal factor will be found in increased pressure in the renal veins. The quantity of albumin present is usually small, and examination of the centrifuged deposit will exclude nephritis. Prognosis will depend upon the influence of therapeutic measures in improving the circulatory condition; with improved general circulation, kidney function is re-established, and a diuresis follows, with disappearance of the albuminuria.

Proteinuria.—Bence-Jones's proteinuria, in the majority of cases, occurs in instances of multiple myelomata; though it has been found associated with other pathological conditions, such as leukæmia, chloroma, lymphosarcoma, myxœdema, and carcinomatous metastasis. The recognition of the protein depends upon its relatively easy precipitation below the boiling point, while, on boiling, the solution tends to clear. The prognosis depends, not on the proteinuria, but on the primary disease. As a rule, it is utterly bad; many sufferers only survive the recognition of their complaint a few months. Cases are on record of a much longer duration, however; one, indeed, where the condition persisted twelve years, and the patient appeared to enjoy fair health. Such cases are, however, exceptional; as a general rule, the recognition of proteinuria justifies a very grave prognosis.

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ALBUMINURIA OF PREGNANCY. (*See also ECLAMPSIA.*)—In this account we shall deal with the prognosis of the *toxæmic albuminuria of pregnancy*. There are, of course, other causes of renal albuminuria in pregnancy, the chief of which are the various forms of nephritis (Bright's disease) and the slight and transient albuminuria so often found during, or immediately after, labour, as a result of the unusual exertions of labour (physiological albuminuria). Inasmuch as prognosis depends so largely on accurate diagnosis, the distinction, in a given case, between toxæmic albuminuria and true nephritis is a very important one, especially as the prognosis of the latter is rendered extremely grave by pregnancy; for the differentiation between these two states (which is not always easy, and depends chiefly on the former history of the patient, the state of the cardiovascular system, and the examination of the fundus oculi), the reader is referred to text-books of obstetrics. In cases of true nephritis complicated by pregnancy, labour or abortion should be induced without any delay whatever, otherwise the disease will make very rapid progress: as the foetus usually dies in utero about the fifth or sixth month, the consideration of the life of the child need not deter one from the unwelcome operation of inducing abortion.

The *toxæmic albuminuria of pregnancy* arises during the last half, usually during the

last three months, of pregnancy ; cases are occasionally met with, notably in association with vesicular mole, where it has occurred as early as the third or fourth month. The frequency of its occurrence is variously given ; albuminuria with tube-casts will be found in about 5 per cent of primigravidae, if the ordinary working tests are used (i.e., the heat test or the cold nitric acid test), and if the urine is examined as systematically as it should be (i.e., at fortnightly intervals during the eighth and ninth, and at weekly intervals during the last, lunar month of pregnancy).

The prognosis will depend mainly on the type of case when first seen, and on the promptness and thoroughness of the treatment, for few conditions are so amenable to treatment as this is.

Prognosis in respect to the Clinical Features.—The type of case usually seen has a gradual onset and is *mild* to begin with. When seen early the patient has a moderate degree of general oedema and a moderate amount of albumin in the urine ; the urine is not much diminished in quantity, the general symptoms of toxæmia, such as headache and vomiting, are either absent or extremely slight, and the blood-pressure is not greatly raised (i.e., not above 140 to 160). In these cases an extremely good maternal prognosis on all points may be given, provided the patient is promptly and correctly treated. The fetal prognosis is also extremely good, but should always be guarded, for the occurrence of retroplacental hæmorrhage or excessive white infarction of the placenta cannot be foreseen or prevented. The influence of correct treatment on the prognosis is so important that it is as well to outline it. In all cases, however slight, the patient must be put to bed and practically starved, and be given saline purgatives : in the first forty-eight hours nothing should be given but barley-water, or an alkaline drink like Vichy water ; afterwards milk and soda-water may be given for the next twenty-four hours. The blood-pressure, the quantity of urine passed, and the amount of albumin should be taken daily, for if the state of the patient does not steadily improve, labour must be induced. The most modern work has shown that great assistance may be expected from renal efficiency tests, as indicating the stage at which induction becomes necessary ; this will be referred to again elsewhere.

The *severer types of case* carry a worse prognosis ; they are severe either because they have not come under treatment in the early stages, or because they were severe from the first. There is an acutely arising type where the patient gets at once severe toxæmic symptoms without the usual preliminary period of oedema and albuminuria. The worst of these cases exhibit a group of symptoms which constitute the 'pre-eclamptic' state ; oedema is usually slight ; there is vomiting, intense headache, dim vision or transient blindness, a high blood-pressure, scanty urine containing a large quantity of albumin, mental dullness or even coma, and, finally, epigastric pain. Such cases are extremely liable to develop into eclampsia, and they call for prompt treatment, i.e., induction of labour, starvation, purgation, venesection, saline infusions, and other eliminative measures. In these cases the foetus usually dies.

The prognosis may further be divided into : (1) *Maternal* : (a) As regards life, (b) as regards the likelihood of eclampsia, (c) as regards the remote effects, i.e., the liability to permanent kidney damage and chronic renal disease ; (2) *Fœtal* : the chances of foetal death or premature labour.

1. *Maternal.*—

a. As regards Life.—Patients never die of the mild or moderately severe types of toxæmic albuminuria, apart from eclampsia. In the severest type described above (the 'pre-eclamptic' state), the patient, without getting convulsions, occasionally dies comatose, especially if there is jaundice or complete suppression of urine ; in such cases widespread focal necrosis and hæmorrhage are found in the liver, and the kidney epithelium is extensively degenerated.

b. As regards the Occurrence of Eclampsia.—Every case of toxæmic albuminuria is liable to get eclampsia sooner or later unless efficiently treated. The crucial question is : Can eclampsia always be prevented by treatment ? In other words, is a patient liable to get eclampsia during treatment ? Yes : in certain circumstances she may ; it all depends on the efficiency of the treatment and on the stage of the disease at which treatment was begun. We have seen a few moderately severe cases get eclampsia after four to five days of half-hearted treatment, i.e., rest and purgation, but, instead of starvation, a light diet

of milk, fish, bread and butter, etc. We have seen severe cases get eclampsia under rest and efficient treatment in which such treatment alone ought not to have been thought of, but in which, in addition, labour ought to have been induced at once. We have never yet seen a case suitable for treatment by rest and starvation get eclampsia when such treatment had been in progress for at least five days. So great an authority as Tarnier said he had never seen eclampsia occur in a patient who had been on strict milk diet for seven days. Under such treatment the œdema usually entirely disappears and the albumin goes almost to vanishing point. It must never be forgotten that the albuminuria and symptoms are very likely to return after the patient is allowed up, so she must be kept under careful observation. The prognosis depends essentially on the results of treatment; it is good if improvement is steady and progressive; if improvement is not satisfactory, risks can be avoided and a good prognosis maintained by the induction of labour; this may mean the sacrifice of the child, but it is the only way to make certain of the life and the future health of the mother, who may hopefully expect her next pregnancy to be an uncomplicated one. (*See also ECLAMPSIA.*)

c. As regards the Remote Prognosis.—Is the patient liable to get permanent renal damage leading to chronic renal disease? She is: but very seldom. There is no accurate information on this point; but it should always be kept in mind. The liability to it is a strong reason for not persisting in conservative treatment too long if the albumin does not disappear; the longer the kidney is passing albumin the greater is the risk of permanent damage to the epithelium.

After delivery, the prognosis as to permanent damage depends on the persistence of symptoms. As a rule the albumin entirely disappears in two or three weeks or less, and the blood-pressure falls to normal in a few days. If raised blood-pressure persists for more than a fortnight, the case becomes suspicious. Albuminuria may last as long as six weeks before disappearing entirely, but such a case should cause anxiety. It is a safe rule to treat all patients with toxæmia of pregnancy for at least six weeks after labour, like cases of nephritis, by careful diet and rest.

2. Fœtal.—The frequency of premature labour lessens the chances of survival of the child, and the fœtus may die in utero from relative placental insufficiency due to excessive infarction, or to retro- or intra-placental hæmorrhage. It is impossible to state in actual figures the fœtal and infant mortality. In severe cases the mortality is about 50 per cent; in mild cases which respond well to treatment, and in which there is no need to induce labour too prematurely, the chances of a healthy child are extremely good.

Renal Efficiency Tests as an Aid to Prognosis.—At the time of writing, most useful papers on this comparatively new aspect of the subject have appeared, notably those by MacKenzie Wallis¹ and de Wesselow.² There seems no doubt that chemical examination of the urine and blood should, in the future, be of definite value in indicating the stage at which induction becomes necessary, and in averting the risk of permanent damage to the mother. According to de Wesselow, where the blood urea is above 40 mgrm. per 100 c.c., and the urea concentration test is below 2 per cent, the termination of pregnancy is indicated. Our own personal feeling is that at present these renal efficiency tests have not become sufficiently standardized, and that the routine clinical experience of the past is, on the whole, a safer guide, though there can be very little doubt that with increased precision they will become of the utmost value.

REFERENCES.—¹Mackenzie Wallis, *Jour. Obst. and Gynæcol. Brit. Emp.* 1921, xxviii, 3; ²O. L. V. de Wesselow, *Ibid.* 1922, xxix, 21. Eardley Holland.

ALCOHOLISM.—(*See MENTAL DISEASES.*)

AMŒBIC LIVER ABSCESS. (*See also DYSENTERY.*)—This is a serious, but now easily preventable, disease. It is always a complication of amœbic ulceration of the bowel, although that disease may be latent. In warm countries, where it is of common occurrence, and about 30 per cent of the cases are multiple, the mortality in cases treated by the open operation is high, having been 58·6 per cent in 295 cases in Calcutta. In the chronic cases seen occasionally in patients invalided to Europe it is considerably less, but figures based on small numbers of such cases are very misleading. The mortality varies greatly in different classes of cases, as shown by the following Calcutta figures:—

Numerous small abscesses, usually found post mortem in cases of dysentery and hepatitis from the medical wards, were formerly always fatal; they constitute 24 per cent of liver-abscess cases in the Calcutta post-mortem records. They have now been proved to be recoverable under the action of full doses of emetine, thus materially improving the prognosis of these hitherto invariably fatal infections. This was demonstrated in a case observed by the writer in which the numerous small liver abscesses were seen during an abdominal section and amœbæ found in pus from one of them, while other recent war workers are in agreement with this statement. Two or more large single abscesses also formed 24 per cent, being usually fatal, especially when treated by the open operation. Single large liver abscesses formed 52 per cent of the fatal cases when they were treated by the open operation, mainly due to secondary septic infection, but are less frequent now in the post-mortem room, owing to their mortality having been greatly reduced. Including recoveries, the proportion of large single abscesses to admissions was 70 per cent, the rest being multiple. In 176 Calcutta cases, in those opened through the chest wall the mortality was 73 per cent, in right-lobe abscesses opened through the abdominal wall in the right hypogastrium it was 59 per cent, and in the rarer small left-lobe abscesses opened in the epigastrium it was only 12 per cent: a most important difference, which must be taken into account in estimating the results of any given line of treatment. In cases opening spontaneously through the lungs, the mortality before ipecacuanha and emetine were generally given was 46 per cent, but it is now quite exceptional to lose such a case. The rare cases in which the abscess discharges into the stomach or bowel do well as a rule without operation.

In addition to the site of the abscess, the following factors influence the prognosis. If the open operation is adopted, especially in hot damp climates with germ-laden air, the larger the abscess cavity the worse the prognosis, on account of the exhausting discharges following the inevitable secondary bacterial infection of the cavity. If aspiration and emetine injections are used, the size of the cavity is of comparatively little moment, some liver abscesses containing six pints of pus having been successfully dealt with in this way. A very high leucocytosis of over 30,000 usually indicates the dangerous multiple small abscesses. The continuance of actual dysenteric symptoms coincidently with acute suppurative hepatitis has the same serious significance. Great emaciation and an alcoholic history are also unfavourable points.

Recent improvements in treatment have altogether altered the outlook in this disease in two important directions, namely, in enabling such a serious complication of amœbic dysentery as abscess in the liver to be prevented easily, and also to be treated more successfully after it has developed through neglect of proper treatment in the early pre-suppurative stage of amœbic hepatitis. The researches of the writer showed that amœbic hepatitis while still in the presuppurative stage, can be detected by the blood changes and rapidly cured by ipecacuanha or, better still, by emetine, and the occurrence of the dangerous suppuration averted; and this success, together with the establishment of the fact that such abscesses are nearly all free from bacteria when first opened, further led him to adopt repeated aspiration of an already formed abscess, combined with the use of the specific drug against the amœba, in place of the open operation, a method which allows the death-rate from tropical liver abscess to be reduced to one-fourth of its former figure. The reduction by these methods is shown by the following figures. From 1904 to 1906 the deaths in the British Army in India averaged 96, or 1·35 per mille, yearly, but have steadily fallen since the writer's paper was published in 1907 until in 1913 they averaged only 10·5, or 0·2, per mille, being one-seventh of the former rate. In the European Hospital, Calcutta, the number of deaths yearly averaged 5 during the six years ending with 1906, and have fallen steadily since, to reach nil for several years.

The following figures illustrate the death-rate from the old open operation in comparison with the modern method of aspiration and emetine administration.

The mortality following the open operation remains high, as Love had a death-rate of 63·3 per cent in Mesopotamia, and Cotte and Chifoliau one of 53·3 per cent in Macedonia. In India Thurston had a mortality of 40 per cent in 45 cases, and K. K. Chatterji one of 60 per cent in 15 cases, by this method. Including 2261 in the British Army in India from 1896 to 1907, and 235 cases collected from Calcutta hospitals, the mortality was 56·8 per cent.

Aspiration combined with specific treatment with ipecacuanha, and later with emetine, was first advocated by Rogers, who reported 19 cases with a mortality of 15·8 per cent, or about one-fourth of that of the open operation. Thurston adopted this plan and recorded 48 cases with 23 per cent of deaths, and regards the open operation as obsolete; while K. K. Chatterji, also working in Calcutta, lost only 6·6 per cent of 33 cases dealt with by Rogers' method; and Talbot, at Baghdad during the war, had 11 successive recoveries after aspiration and emetine, or a total mortality of 14·4 in 111 cases, the prognosis of the disease being thus materially improved by the reduction of the death-rate to one-fourth of that of the open operation. These successes are largely due to the recognition of the specific action of ipecacuanha and emetine on amœbiasis, as shown by Thurston's studies of 100 cases in India with a mortality of 40 per cent without these drugs, mostly his earlier cases treated by the open operation, and 28·6 per cent with the addition of ipecacuanha and 25 per cent with the use of emetine.

Leonard Rogers.

ANÆMIA, APLASTIC.—This condition is apparently due to an exhaustion of the bone-marrow or to its inability to respond to calls upon it. It follows severe septic and toxic conditions; in some of these the anæmia is aplastic from the beginning, so that regeneration never takes place; in other cases, regeneration may first occur and then fail. Sometimes it has followed on pernicious anæmia. We have known cases occur after repeated or continued hæmorrhage. [A well-known *x*-ray worker has recently died of this disease.—ED.] In many instances no causal condition can be discovered, and in these we may suppose that an inherent vulnerability or weakness of the marrow renders it unable to respond to any extra demand on its functions. In most cases, however, aplastic anæmia is to be regarded as the terminal phase of a serious disease. The only possible chance of a favourable outcome would be the discovery of a removable cause. This, however, is a remote contingency, but it occurred in the case of a few workers among trinitrotoluol in munition factories during the war. As a rule, a fatal termination may be expected in a few weeks or months. In one of our cases there was a history of anæmia for only three weeks before admission to hospital; the red corpuscles numbered 1,300,000 per c.mm. Death took place ten days later; the red cells had decreased to 800,000. Another case gave a history of progressive anæmia for two years; his red-cell count was 625,000. Death occurred in seven weeks, the count having fallen to 340,000 per c.mm. Among the signs which indicate that a fatal outcome is imminent are a low red-cell count and a low leucocyte count, especially a diminution of the granular cells.

If nucleated red cells have been present, and either diminish or fail to increase in number as the red-cell count becomes progressively lower, we would suspect that the anæmia was aplastic. In both severe secondary and pernicious anæmia we usually expect to find that the nucleated red cells become more numerous in the blood as the corpuscular count drops. The occurrence of hæmorrhages is an unfavourable indication, and an attack of intercurrent disease renders a fatal issue doubly certain.

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ANÆMIA, PERNICIOUS.—(See PERNICIOUS ANÆMIA.)

ANÆMIA, SECONDARY.—Secondary anæmia may arise from a great variety of causes, and practically the only condition in which the prognosis is not more influenced by the causal factor than by the bloodlessness is post-hæmorrhagic anæmia.

Acute Post-hæmorrhagic Anæmia may be immediately fatal. No other condition causes so much anxiety to the patient. Pallor, giddiness, and faintness may be noticed before much blood has been lost. As soon as the blood-loss has become severe, the pulse becomes low in tension, small in volume, and irregular. All of these symptoms are readily recovered from.

More serious are hiccough, nausea, and vomiting. Persistent syncope is a very grave indication. Fibrillary tremors and delirium are of even more serious omen, and after convulsions have occurred recovery rarely follows.

If the hæmorrhage is checked before a fatal result takes place, the patient is not yet out of danger. The blood is diluted by fluid from the tissues, and its respiratory value is thereby diminished; it is also possible that the resulting hydræmia leads to a destruction of some of the less resistant corpuscles.

The maximum severity of the anæmia is therefore not reached till some days after the actual hæmorrhage, but the danger to life is not so great as during the initial loss of fluid. A return of syncope and nervous symptoms at this stage would be a serious indication. It is hardly necessary to discuss immediate prognosis in the case of actual hæmorrhage, since the matter is determined at once. When a serious hæmorrhage has been arrested, it may be of vast importance to be able to estimate the subsequent course of events.

The suddenness of the hæmorrhage is a factor. If blood be lost slowly, or in two or three repeated hæmorrhages, the patient has a better chance of life than if the same, or even a less, quantity of blood were lost rapidly; as, in the former case, there is more time for the relationship between the body-fluids and blood-pressure to be readjusted, and for some amount of regeneration of blood to take place. Infants and young children bear the effects of hæmorrhage badly, but in the cases which survive, regeneration is very rapid after two or three days.

Elderly and weakly persons will obviously be worse subjects for a hæmorrhage than the middle-aged and robust.

In cases which do badly, the appetite almost entirely fails, there is nausea and sometimes sickness. The heart acts feebly and irregularly, fainting occurs, with or without change of posture, and fatal syncope ensues. Patients are querulous and irritable, and permanent damage may be done to the nervous system. Among the most distressing consequences is blindness, sometimes due to optic neuritis, sometimes to no discoverable lesion. The loss of vision is usually partial, and may be either a general amblyopia, or a scotoma, often central. Such results are fortunately very rare.

It is sometimes asked how much blood can be lost without a fatal issue ensuing. This question can hardly be answered; so much depends upon the suddenness of the hæmorrhage and the age and strength of the patient. It may be said that if a robust adult is still alive by the time a hæmorrhage is arrested, the chances are greatly in favour of his complete recovery.

We can recall the case of a housemaid who was suddenly the subject of a large hæmatemesis. This was repeated the following day. A blood examination showed red corpuscles 400,000 per c.mm.; hæmoglobin something immeasurably low—less than 5 per cent. This case gave rise to great anxiety for several days, but the patient made an uneventful recovery. We hardly expect ever to see this case paralleled.

The rate of blood-regeneration varies with the severity of the blood-loss and the condition of the patient. A robust patient will replace a blood-loss of 30 to 50 per cent in a month or six weeks. Several months might elapse before such a hæmorrhage was made good in an elderly or weakly person.

Early treatment by transfusion of blood may be the determining factor in the recovery of a case of a severe hæmorrhage. It is important that the blood transfused should be of the appropriate group (*see* PERNICIOUS ANÆMIA). If blood is not available, injections of saline solution or of gum may get over the emergency due to loss of fluid, but the results are probably not so good as those which follow the use of blood.

It is often desirable to know the limits of anæmia which justify surgical intervention. Mikulicz long ago laid it down that operations should not be performed when the hæmoglobin percentage was under 30. This appears to us to be as just and reasonable as any arbitrary rule in medicine can be. The cases where operation is demanded are chiefly those in which the operation is calculated to arrest hæmorrhage. We can quote the following. In one instance hysterectomy was performed for bleeding fibroids after the hæmoglobin percentage had fallen to 24. In another such case, the blood-examination before the operation revealed red corpuscles 2,000,000, hæmoglobin 30 per cent, leucocytes 15,000. A fortnight later the corresponding figures were 2,900,000, 50, and 7500. It should be remembered that, in skilful hands, hysterectomy is practically a bloodless operation.

The blood examination may give some guidance to the eventual outcome of hæmorrhage. A leucocytosis beginning from eight to twelve hours after the bleeding indicates two things: first, that the hæmorrhage has been at least moderately severe; and second, that the marrow is showing signs of reaction.

The appearance of nucleated red cells about the second or third day is also an

indication that the hæmorrhage has been severe. Some guidance as to the progress of regeneration may be obtained by noting their relationship to the degree of anæmia. A moderate number is to be expected in all severe anæmias.

Their absence after repeated search, in a case of severe anæmia, would indicate a slowness or deficiency of regeneration on the part of the marrow.

Chronic Secondary Anæmia.—The least complicated condition is that due to repeated hæmorrhages. Among the common causal factors are bleeding piles, menorrhagia or metrorrhagia, gastric and duodenal ulcer, and worm infections. These are all curable conditions, and so far as the anæmia is concerned, it is imperative that treatment should be sufficiently early and energetic to forestall such a loss of blood as would leave the patient with a hæmoglobin percentage of 40 or 30. As already seen, the latter is about the lowest limit at which surgical operations are practicable. If it is impossible to deal with recurrent bleeding, fatty degeneration of the organs will ensue. The heart becomes feeble and irregular, appetite and digestion fail, œdema becomes evident, there may be petechial hæmorrhages and nervous symptoms. Death occurs from heart-failure or from failure of tissue-nutrition. A falling leucocyte count and a disappearance of nucleated red cells will indicate that the case is becoming one of aplastic anæmia (q.v.).

Anæmia due to improper nourishment and unfavourable surroundings is not usually very severe, and is easily curable when the environment is improved. Chronic secondary anæmia is also associated with a variety of toxic conditions—sepsis, fevers, syphilis, malignant disease, and exhausting diseases such as nephritis, chronic catarrh of the alimentary system, and so forth. In many of these, the anæmia may become so pronounced as to be an element to be considered in estimating the outcome of the disease, but in all cases it would be taking an incorrect perspective to attempt to gauge the severity of the condition from the anæmia, rather than from the broader point of view of the influence of the causal condition.

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ANÆMIA, SPLENIC, OF ADULTS.—In estimating the prognosis of a case of splenic anæmia, it is advisable to try to distinguish between true splenic anæmia or Banti's disease, due to an overgrowth of fibrous tissue in the spleen and at a later stage in the liver, and primary splenomegaly or Gaucher's disease, where the essential lesion is a proliferation of endothelioid cells in the spleen. The latter condition is to be suspected, especially in young subjects, when other members of the family have been similarly affected, when there is a peculiar grey pigmentation of the skin, and when anæmia (in the initial stages) is slight. It may be noted, in the first place, that a very few cases diagnosed as true splenic anæmia by competent observers have apparently recovered without operative interference.

Goetz¹ records the case of a girl who had been delicate from birth. At the age of five years an enormous enlargement of the spleen was discovered. The number of red and white corpuscles was normal. Hæmoglobin was reduced to 70 per cent. There were repeated attacks of hæmatemesis, and ascites had to be relieved by tapping on several occasions. The child survived attacks of measles, bronchopneumonia, and croupous pneumonia. At the age of fourteen an attack of hæmatemesis occurred, but the spleen had by this time diminished in size. No further symptoms occurred, and three years later the spleen could not be felt and the girl appeared to be in perfect health. One of us has recently seen an almost exactly similar case.

Winter² reports the case of a man of fifty, whose spleen had been enlarged for at least four years. He had suffered from hæmatemesis and melæna, and the red-cell count fell to 1,800,000 per c.mm. Under treatment, the number of corpuscles rose to 4,800,000, and the patient returned to work, although the spleen remained large. Most of such cases have been treated with arsenic, or arsenic with iodides.

Thirteen years ago, a youth of eighteen, suffering from splenic anæmia in an early stage, came under the care of one of us. Gastro-intestinal symptoms were very pronounced, and treatment directed towards the alimentary canal led to what has apparently been a complete recovery.

Such favourable results as the foregoing are by no means common. Benefit sometimes follows the application of *x* rays to the spleen, but it must be admitted that in the majority of the recorded cases their use has not influenced the course of the disease. We

can recall the case of a girl of seventeen who had a remission of symptoms for five years after a course of x -ray treatment. Symptoms then returned and ascites was found. The further application of the rays failed to do good. Another case is that of a lady, age fifty, with an enlarged spleen. She has had many exacerbations, but since the application of x rays she has had a remission of eighteen months' duration.

Yet another case seen in 1910 had a history of hæmatemesis and the spleen was very large. It was greatly reduced in size under treatment by x rays, and the general condition improved greatly. In 1921 the patient reported having had one severe and two slight attacks of hæmatemesis. He was then found to have severe anæmia, cirrhosis of the liver, slight ascites, and the spleen nearly reached the level of the umbilicus. Radium was applied over the spleen, and the symptoms greatly improved. Radium appears to act more effectively and certainly than x rays. (See LEUCOCYTHÆMIA.)

When a case is doing badly, or when the disease appears to condemn a patient to a life of more or less complete invalidism, the problem of prognosis resolves itself into the question whether removal of the spleen can be safely accomplished. The outstanding fact in this connection is that a large number of thoroughly successful cures have been effected. Immediate benefit has frequently followed in cases previously doing badly. A few unsuccessful cases have also been reported, and the presumption is that a good many more have been left unrecorded. Cases have died of hæmorrhage or shock immediately after the operation; others have been carried off by pneumonia; and yet others have died of vague gastro-intestinal symptoms after a short interval. Armstrong³ collected 32 cases of splenectomy for splenic anæmia. Complete recovery followed in 22 instances; a fatal result from hæmorrhage or shock occurred in 9 cases; 1 patient was unrelieved. At the discussion on the subject, reported in the *Proceedings of the Royal Society of Medicine*, June, 1913, 6 cases of splenectomy were reported; in all six the patient recovered and the anæmia disappeared. The great majority of successful splenectomies have been in young subjects. In 3 recent cases under the care of one of us, which were all at the stage of large spleen with commencing anæmia, with no ascites and no other contra-indication, splenectomy was performed. The operation was fatal in each case. But in another case operated on six years ago there has been complete return to health, and several other cases operated on since have done well.

In dealing with cases of splenic anæmia it should be remembered that its course is usually extremely chronic. Little change may be manifested for years. Even a downward tendency is seldom progressive. Exacerbations may be followed by long remissions, and the patient may continue to show little change. The standard of health after an exacerbation is likely to be lower, but lost ground is sometimes recovered. The number of leucocytes per c.mm. serves as a rough prognostic indication. It is always diminished, but as long as it does not drop below 4000 the case is usually doing well. We have seen it drop to 210 shortly before death.

The greatest danger lies in the possibility of intercurrent disease, and this is the usual cause of death. The possibility of sudden hæmorrhage, too, is always a source of danger. Hæmatemesis, ascites, and exhaustion close the normal history of the disease.

The risk of hæmorrhage increases with increasing anæmia, and therefore, in cases where splenectomy is thought desirable, the operation should not be too long delayed.

Another risk of delay is that the result of an intercurrent affection may diminish or abolish the feasibility of surgical aid. We have seen one such case, where fibrosis of the lung followed an attack of pneumonia and rendered the performance of splenectomy out of the question.

Where operation is contemplated, and the presence of ascites might be recorded as a bar, the effect of a preliminary tapping might be tried. We had one case, a boy of sixteen, suffering from splenic anæmia of the Gaucher type, in whom a single tapping kept the patient free from ascites for two years. It ultimately returned, and the patient died of cardiac failure; he suffered also from mitral stenosis. In the later stage of Banti's disease, splenectomy combined with a Talma or Drummond-Morison operation might offer the chance of amelioration. One success has been recorded by Tansini.⁴

In recent years, surgical technique has advanced to such an extent that the case for splenectomy in this disease has become strengthened. An important measure in cases where the spleen is large is the preliminary use of x rays or radium to reduce the size of

the organ to manageable dimensions before operation is undertaken. One of us has at present in his wards two cases where this is being done.

In primary splenomegaly (Gaucher), the course may be very prolonged. In Gaucher's own case the spleen had been enlarged for twenty-five years. The condition is more common in young subjects, and most of them are carried off by intercurrent affections. The data regarding splenectomy are very scanty. A few successful cases have been recorded, and there appears to be no alternative which offers a reasonable hope of success.

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ANÆMIA, SPLENIC, OF INFANCY.—This condition usually occurs in children between the age of ten months and two years, and these limits are very seldom overstepped. It is not yet settled whether the splenic anæmia of infants is a mere secondary or symptomatic anæmia, or a special form occurring in infants. The latter is probably the correct view. Although the cause and concomitants may vary, the clinical picture and the blood-changes are constant and definite. It is associated with rickets in the great majority of cases. The estimation of prognosis is not easy. Recovery takes place in a large proportion, probably the majority, of cases. More cases die of a complication than of the anæmia itself. Pneumonia most frequently determines a fatal outcome. The severity of the rickets or other causal condition, and the general condition of the patient, are the chief guides to prognosis.

Marked emaciation, severe gastro-intestinal disturbance, or any complication, adds to the gravity of the outlook. Petechial hæmorrhages or other manifestations of purpura are particularly unfavourable. The size of the spleen gives no indication of the severity of the condition. The examination of the blood yields useful prognostic indications. The most serious is a very marked reduction in the number of the red corpuscles; counts below 2,000,000 per c.mm. indicate dangerous possibilities, and this is especially the case if the colour index is low. The number of nucleated red cells in the circulating blood appears to have no relationship to the severity of the anæmia or the gravity of the prognosis, nor is it a matter of practical significance whether the majority of the erythroblasts are normoblasts or megaloblasts. A high leucocyte count, e.g., over 60,000, is to be regarded as a serious indication. The presence of a few myelocytes has no special significance, but a large number, or an abnormally high percentage of lymphocytes, is of more serious import. Fowler lays stress on the grave significance of a high proportion of transitional forms. Other things being equal, the more nearly the leucocyte picture approaches that of a simple polymorph leucocytosis, the more favourable is the case.

The best of all prognostic indications will be provided by the response to treatment. If a case begins to improve, a favourable outcome may reasonably be expected. Good hygienic surroundings, and treatment directed towards the amelioration of the general health and the removal of the causal condition, are more likely to be followed by good results than more specific measures.

Arsenic and iron are not so clearly indicated as in most other anæmias. They may do good, but they should be employed with caution. The application of x rays, in our experience, does more harm than good; but we can recall one case in which improvement took place either under, or in spite of, the action of radium applied to the spleen. Splenectomy is not to be entertained. The enlargement of the spleen persists long after the anæmia has been cured. A greatly enlarged spleen may not become impalpable till after a year has elapsed.

Cowan has reported two cases in which the condition appears to have passed into the adult form of splenic anæmia.

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ANÆSTHETICS.—The data required for arriving at an accurate forecast as to risk to life under anæsthetics and analgesics are at once difficult to obtain and still more difficult to apply to any individual case.

Factors other than the Patient.—**THE ANÆSTHETIC.**—If we employ the statistical method, an examination of the figures upon which conclusions are based as regards any

given anæsthetic reveals their fallacy. This arises from several causes: no uniform system of recording anæsthesiæ exists, and in places in which records are made these last are usually incomplete. It is recognized that at least three factors may have caused death, either singly or by interaction: (1) The anæsthetic may prove fatal as a result of an overdose having been given; or because a faulty method has been pursued, or faulty selection of the drug has been made; or because the drug was impure. (2) The condition of the patient through shock, pre-existent disease, or accidental intercurrent complications such as a hæmorrhage into the tissues of the nervous centres, vomiting, or other cause of obstruction to respiration, may bring about death even although the anæsthetic has been properly given and rightly selected. (3) Complications arising through operative procedures, such as severe trauma, hæmorrhage, malposition of the patient leading to flooding of the air-passages with foreign material such as pus in operations for empyema, blood during operations upon the jaws, tongue, and upper air-passages, may bring about a fatal result, and may do so independently of any specific action of the anæsthetic. Such deaths are commonly grouped as fatalities due to the anæsthesia. It will therefore be expedient to give the massed statistics in this place and then consider separately the various factors which are involved in all cases of anæsthetic accidents.

The massed statistics have this value, that they demonstrate, even if roughly, the incidence of danger under various anæsthetics and during the use of different methods of their employment.

As a rule, such statistics represent the experience of anæsthetists of every degree of proficiency; but it has to be borne in mind that there is a sharply defined difference in the figures supplied by specialists—i.e., expert anæsthetists of wide experience—and those recorded by practitioners who have no special knowledge and in many cases are mere tyros in the practice of anæsthesia.

Further statistics given of complicated or less-known anæsthetic methods demonstrate that as such methods become more fully known and their technique becomes more accurate, the expectancy of life becomes more favourable to the patient. We may take the example of spinal anæsthesia to illustrate this point, since that system is usually pursued by trained persons rather than as a routine procedure. Strauss in 1909 collected records of 22,717 cases of spinal anæsthesia with a mortality of 7 persons—that is, roughly, 1 in 3245; between 1908 and 1914, in 28,746 cases the mortality was 1 in 1200; in 1915 to 1917, 1 in 16,000; but this last estimate includes statistics from various sources which are of doubtful value. Barker's figures, although few, indicate a rapidly falling danger-rate as his experience with regard to the choice of cases suitable for the plan increased and his technique improved. Even with such reservation as is indicated, we find that these figures show clearly that the experience and judgement of the anæsthetist is a prime factor in determining the risk to life under anæsthetics and during the use of special methods.

Massed Statistics.—Death-rate under various anæsthetics:—

Coles (Virginia) -	-	records	152,260	and	53 deaths,	or	1-2873
Richardson (England) -	-	"					1-2500
Gurlt (Germany, 2 years)	-	"	34,401	"	29	"	1-1186
Julliard (Geneva)	-	"	524,507	"	161	"	1-3257

These results, taken together, give a mortality of 1 in 2454.

War statistics necessarily differ from those obtained in civil practice. Bandeus (Crimea) gives 1 in 10,000, which is possibly inaccurate, although the figures given of the deaths under chloroform during the War of Secession, 1 in 11,448, are similarly favourable.

Unfortunately, nothing approaching a complete statement concerning the incidence of deaths under anæsthetics during the Great War is obtainable. The experience gained does, however, indicate certain facts, which have been published by Dr. G. Marshall. In casualty clearing stations, recently wounded men—i.e., when operated upon within forty hours of injury—were peculiarly liable to a dangerous fall in blood-pressure and to post-operative pulmonary complications. Chloroform proved very fatal; ether was slightly less so, but here the method employed was important. B. Hughes found endotracheal etherization satisfactory and intravenous instillation of value in cases of marked collapse; the consensus of opinion, however, points to nitrous oxide and oxygen being the anæsthetic

of choice under war conditions, but only when given by one well versed in its use. Spinal anæsthesia given after forty hours was spoken well of by some surgeons, but stovaine introduced intrathecally was liable to produce serious fall of blood-pressure, causing cerebral anæmia; G. Marshall has noted two deaths from this cause. It was found that an important factor in bringing about a safe or dangerous anæsthesia was the experience of the anæsthetist and his preoccupation.

The prognosis in these anæsthesiæ, although incapable of being accurately determined, was unfavourable in the early hours of shock, less hopeless if the man survived forty hours, and most free from traumatic risks after evacuation to a base hospital. But in the earlier phases of the cases, the results of trauma and anæsthetic shock were so closely mingled that it was difficult in most instances to determine which factor was dominant.

As is pointed out in another section, the psychic effect upon the individual arising from fear of an operation or anæsthetic is an important one, and is peculiarly likely to arise in the case of wounded soldiers, especially those classifiable as neuropaths.

In the large number of hospitals in the United Kingdom very many anæsthetics were given to soldiers, but again no satisfactory statistics are obtained. If records have been kept, they are still unclassified. Through the kindness of Colonel Silk, of the Southern Command, I am able to give statistics covering a period of one year (1918), and these no doubt present features common to other commands. The following are the statistics of thirteen military hospitals for one year:—

Anæsthetic	Number of Administrations	Number of Deaths	Mortality
Chloroform - - - - -	1492	2	1-746
Ether - - - - -	6172	2 (open method)	1-3086
Mixtures of chloroform and ether - - -	18,205	4	1-4551
" " and ethyl chloride - - -	—	1	—
Nitrous-oxide gas (?) with oxygen - -	3054	1*	1-3054

* A desperate case.

These figures show very little beyond the fact that chloroform and mixtures containing it are the most dangerous, and this is in consonance with general clinical experience gained in this country, in the U.S.A., and abroad.

Gwathmey¹ collected 278,945 cases from 99 hospitals with the following results in civilian practice (1905-11):—

Form of Anæsthesia	Cases	Deaths	Mortality
Local analgesia - - -	14,878	0	—
Nitrous oxide and oxygen - -	8,585	0	—
Spinal anæsthesia - - -	521	0	—
Chloroform and ether sequence -	16,054	2	1-8027
Nitrous oxide and ether sequence -	41,435	6	1-6905
Anesthal* (Weidig) - - -	6,139	1	1-6139
Ether (drop or vapour) - - -	157,453	28	1-5623
Ethyl chloride, ether sequence -	4,331	1	1-4331
Chloroform and oxygen - - -	4,009	1	1-4009
Chloroform (drop or vapour) - -	16,390	8	1-2048
Nitrous oxide - - - - -	1,314	2	1-657
Rectal (? ether) - - - - -	516	1	1-516
Intratracheal (? ether) - - -	1,000	4	1-250
Nitrous oxide, ether, and chloroform sequence - - - - -	183	1	1-183

* Composed of 17 per cent ethyl chloride, 35·89 per cent chloroform, 47·10 per cent ether (Weidig); but other mixtures are known under this name.

American naval statistics (1908-10) give 2921 cases with 2 deaths (both under ether), or 1 in 1460·5; American army (1904-10), 21,612 cases with 4 deaths (all under chloroform), 1 in 5403.

If the more commonly used anæsthetics are considered individually, the following results emerge.

Nitrous-oxide gas, given for brief operations—such, for example, as occur in dental practice—is usually regarded as the safest anæsthetic, the estimated mortality being given as 1 in 1,000,000 cases. However, more complicated methods are now in use, and this percentage is probably too favourable. The use of the mixture of nitrous oxide and oxygen is probably safer.

Either of these anæsthetics given in long cases—i.e., in major surgery—is far less safe. Some authorities give a death-rate as 1 in 200, while Gwathmey suggests 1 death in 10,000 as representing an average for nitrous oxide and oxygen in general surgery. This figure appears to have been arrived at from reports of fatalities reported to Dr. Gwathmey, and refers, we gather, to the United States.

Ethyl chloride, again, has a far more favourable death-rate in short cases than when used for long operations. The figures given by various authorities differ widely: thus A. C. Wood's tabulation of 51,507 cases makes the death-rate 1 in 5710, while Peterka has collected 100,971 with a mortality of 1 in 8414.

Ether, in this country, has a more favourable showing than that given by Gwathmey as representing the mortality in the United States of America. It is probably between 1 death in 13,000 cases and 1 death in 16,000 administrations, although many expert anæsthetists return a total of many thousand cases without a death. There are no reliable statistics to serve as a comparison between the relative safety of the open-ether method and the closed method. This last procedure is at present usually adopted when a sequence method is contemplated, the ether being introduced either by nitrous oxide or chloroform.

A further difficulty arises when we attempt to estimate the safety of ether, due to the fact that many deaths occurring after the employment of that anæsthetic take place some days after the administration of the ether and are commonly attributed to pulmonary after-effects. That some such cases occur is no doubt true, but most reliable observers believe them to be seldom due entirely to the anæsthetic or the method by which it is introduced.

Again, statistics are wanting to indicate accurately the death-rate under ether when such procedures as colonic etherization, intratracheal insufflation, and intravenous instillation are pursued.

Chloroform shows statistics which are singularly uniform, placing the mortality as about 1 in 3000 cases. However, Lawrie quotes 30,000 without a death; other expert anæsthetists also record few or no deaths in their practice, and the use of such regulating inhalers as the Vernon Harcourt gives a most favourable expectancy of life in the case of chloroform.

The statistics dealing with deaths in the United Kingdom during 1918 (*see* Table on opposite page) are given in the Annual Report of the Registrar General, and are in agreement with previous figures.

The incidence of fatalities in various operations is of importance: 19 cases of operation for hernia; 18 for empyema thoracis; 18 for removal of tonsils and adenoids; 17 for cancerous disease; 15 for intestinal obstruction; 12 for circumcision; and 11 for appendectomy. Of these, it will be seen that a large number of cases occurred when the state of the patient and nature of the operation as such presumably did not determine or predispose to the casualty.

In his remarks, the Registrar points out that although the returns made during the preceding seven years showed no constancy, yet they were much the same as the figures cited. There were 261 deaths in 1915, and 306 in 1916. The deaths under chloroform were always more than those due to other anæsthetics.

The actual quality of the anæsthetic cannot be ignored. When impurities exist, danger prevails. Preparations allowed to be exposed to light and air for a considerable time become altered in their chemical composition, and various by-products of decomposition develop. Chloroform has been considered dangerous when it has been exposed to heat and damp air, and recently even ether as ordinarily prepared has been accused of causing more or less serious complications in anæsthesia. A specially prepared substance called ethanesal has, it is stated, removed these dangers. At present we possess too narrow an experience with this anæsthetic to estimate its merits, but it may be accepted as a safe

STATISTICS OF DEATHS UNDER ANÆSTHETICS IN UNITED KINGDOM.

Anæsthetic	AGES.																	All Ages	Total	
	0-1	2	3	4	5	10	15	20	25	30	35	40	45	50	55	65				
Chloroform -	{ M F	6 1	1 1	1 1	3 3	3 2	4 2	3 2	4 2	5 3	2 4	3 7	6 2	1 0	2 1	4 2	1 0	49 32	}	81
Chloroform and ether mixture -	{ M F	- 3	- 1	1 1	1 1	3 3	- -	1 -	7 -	2 1	3 1	2 2	1 2	1 1	1 -	5 1	2 2	30 19		
Chloroform followed by ether -	{ M F	3 -	- -	- -	- -	1 -	- -	2 -	- -	1 -	- -	- -	- -	1 -	- -	- -	- -	6 2	}	8
Ether -	{ M F	2 -	- -	- -	1 -	- -	2 1	3 -	- -	- -	5 1	- -	- 2	- 3	7 1	1 3	1 1	22 12		
Nitrous oxide and ether -	{ M F	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 -	- -	- -	- -	- -	0 1	}	1
Alcohol and ether mix- ture -	{ M F	1 -	- -	- -	- -	1 -	- -	- -	- -	- -	- -	1 1	1 1	- -	- -	- -	- -	4 2		
Ethyl chlor- ide -	{ M F	- -	- -	- -	- -	1 -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 0	}	1
Ethyl chlor- ide fol- lowed by chloroform and ether	{ M F	- -	- -	- -	- -	- -	- -	- -	1 -	- -	- -	- -	- -	- -	- -	- -	- -	1 0		
Cocaine -	{ M F	- -	- -	- -	- -	- -	- -	- -	1 -	- -	- 2	- -	1 -	- -	- -	- -	- -	2 2	}	4
? Eudrenine	{ M F	- -	- -	- -	- -	- -	- -	- -	- -	1 -	- -	- -	- -	- -	- -	- -	- -	0 1		
Novocain -	{ M F	- -	- -	- -	- -	- -	- -	- -	1 -	- -	- -	- -	- -	- -	- -	- -	- -	1 0	}	1
Stovaine (spinal) -	{ M F	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1 -	- -	- -	- -	- -	1 1		
Stovaine (local) -	{ M F	- -	- -	- -	1 -	- -	- -	1 -	- -	- -	- -	- -	- -	- -	- -	- -	- -	0 2	}	2
Nature of anæsthetic not given	{ M F	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	55 36		
Total -		16	3	4	8	15	9	12	16	13	18	16	18	7	12	16	8	91		282

substitute for ether in suitable cases. Recent investigations² have shown that the ether in common use contains various impurities, viz., dimethyl, diethyl, and methyl-ethyl ethers, and, after exposure to oxidizing agents, alcohol, water, acetone, mercaptan, and thio-ethers. When these are removed, the remaining 'pure' ether loses its anæsthetic powers. The addition, however, of certain ketones restores the anæsthetic properties. Ethanesal, the resulting product, is reputed to act satisfactorily, and to be more free from unpleasant after-effects than sometimes follow the employment of the common ethylic and methylic ethers. If this contention is sustained by further experience, the use of the drug ethanesal would improve the prognosis of ether, especially in the case of patients who have been shown to be greatly distressed by inhaling ethers of the usual types.

THE ANÆSTHETIST.—In individual hospitals we find that the death-rates differ ; and when we investigate the possible reason for this, we find that the death-rate varies directly as the type of the anæsthetist. When the administrator is a student who has a brief tenure of office, the results are unfavourable ; when special men undertake the duties of anæsthetist, and remain in office for a long time, or when expert anæsthetists are employed, the death-rate is lowered. We may conclude, then, that one factor of importance is the anæsthetist. When he is well trained, and gives his undivided attention to his work, the safety of the patient is greater. Nor is this due merely to the hypothesis that such an individual adopts the best methods.

THE METHOD EMPLOYED.—These methods vary within the widest limits ; and while one person will extol one type of procedure, another will prefer one which differs from the other *in toto et in parte*. If we compare the results obtained by the two men, they being expert in their peculiar systems, we find their results practically identical. But if their methods are pursued by a large number of students, most of them lacking in experience and judgement, and liable to errors of technique, we discover that methods do really constitute an important factor making for danger or safety, for the incidence of death is favourable with some methods, unfavourable with others.

Recurring to the administrator as a factor, we find, further, that few experienced men at the present day adopt one anæsthetic or one method to the exclusion of all others, and so the important element of judgement, itself the result of wide experience alike of failure and success, comes to play an important part ; and the *selection* alike of the anæsthetic and the method intervenes and modifies the incidence of danger. As indicated above, the importance of a correct choice of anæsthetic and method of exhibiting it is even greater in war surgery than in civil practice, and may, and indeed does, affect the prognosis in a marked degree.

The Patient as a Factor.—**THE CONDITION OF THE PATIENT.**—Age, sex—although to less degree—physique, temperament—e.g., fright or calm—intercurrent pathological states tending to depress the patient's resistive power, each and all influence the incidence of danger under anæsthetics. There are various diseases or acute illnesses which make for danger when certain anæsthetics are used, although perhaps they may not interfere with the employment of another agent. Let us make this clear by an illustration. Nitrous-oxide gas is regarded, and rightly so, as being the least dangerous of the general inhalational anæsthetics ; and yet, if it is employed for a patient suffering from some obstructive disease affecting his air-passages, e.g., angina Ludovici, the risk to the patient's life is infinitely greater than would be the case if chloroform, an anæsthetic at the opposite pole to nitrous-oxide gas as regards safety, had been employed. The inexperienced man would probably select nitrous-oxide gas for such a case, pursuing general principles, and kill the patient ; the experienced man would select the chloroform, and save the life.

The statistical method fails us in this particular type of case. It would be recorded as a death due to nitrous-oxide gas ; and although such was actually the fact, yet it does not in any way demonstrate that this anæsthetic, as such, is less safe than chloroform ; indeed, the opposite is certainly true. It further happens that in many cases the condition of the patient is so serious that it becomes absolutely necessary either to deny him the benefit of an anæsthetic, and often by so doing increase his risk through shock, or to select an anæsthetic or analgesic which is peculiarly free from risk to life. Under such conditions, many may die, and the statistical method would, by recording such deaths against the practically innocuous anæsthetic which was selected, create a spurious death-rate for it. Statistics, as obtained from death certificates in various countries, are certainly incomplete. Many deaths due to an anæsthetic are recorded as 'heart failure', or some similar condition. Again, in the case of coroners' inquests, the patient who dies through stress of the operation is often assumed to have died from the anæsthetic if he was under its influence when death occurred.

THE NATURE AND GRAVITY OF THE OPERATION.—This is another factor, which has made itself evident in the illustration just given. Now, in all the statistics at present in our hands, the grand totals merely reveal the actual number of deaths occurring under any given agent ; no account is taken, either of the method adopted, itself often as important as the anæsthetic ; of the experience and ability of the administrator ; of the nature of the operation—for example, whether it was upon the air-passages, and so likely

to cause special dangers under an anæsthetic ; of the severity of the operation, its duration, and the degree of trauma it necessitated ; of the condition of the patient as regards resistive power ; or of the presence of intercurrent toxæmia, asphyxia, shock, and so on.

The only exact method of arriving at the incidence of danger of anæsthetics is by experiment, but here again the plan supplies less information than we need in the present investigation. It tells us that any given anæsthetic, or succession or mixture of anæsthetics, acting under known conditions of time and circumstance, upon normal individuals, will produce certain results. We can estimate the progressive effects of increased concentration, or of limitation of oxygen or of carbon dioxide ; but although we can crudely reproduce a few pathological conditions, we cannot with certainty learn by this means what are the effects of the interaction of either anæsthetics or analgesics upon diseased tissues. The perversion of the nerve-controls existent in cases of exophthalmic goitre ; the congeries of conditions grouped under the term lymphatism ; those conditions which underlie the state called delayed chloroform poisoning : these are incapable of experimental reproduction in a form which would enable us to estimate the incidence of danger when anæsthetics are in use in their presence.

We must, however, consider as the first step in arriving at a prognosis in any type of patient under any anæsthetic, the accepted physiological behaviour of the anæsthetic towards normal individuals ; and next, since pathological states are but variants from the physiological, we can deduce the probable effect of any given anæsthetic when acting upon a patient with a known morbid lesion. For example : we know that nitrous-oxide gas lowers the actual oxygen content of the blood, and hence of the tissues ; further, that at a point this declension will produce tissue asphyxia. Now, if pathological lesion of the patient has, by its effects, already lowered the oxygen content of the tissues, the administration of nitrous-oxide gas is probably contra-indicated ; or if this anæsthetic is employed, we should look for a much speedier superinduction of asphyxia than in the normal person. In this case the choice of the method would come to our aid ; for by employing an appropriate mixture of this anæsthetic with oxygen, the danger in certain cases would be obviated. Thus we see that we cannot separate the anæsthetic itself from the method of its employment, if we are to arrive at a precise prognosis or incidence of danger in any given type of cases.

A further difficulty is encountered in our inquiry when we pass from the *type* of patients to any *individual* member of the group. Although he may conform to the peculiarities of the group, yet he will in very many cases reveal some departure from these which is apt to invalidate any general statement as to his immunity from danger. We have to deal with two entities, the conscious and the anæsthetized ; and since the bridging over the passage between perceptive sentience and anæsthesia—the period of induction—is the acme of the curve of danger in any form of anæsthesia, we are compelled to study the psychological reaction of the patient towards the anæsthetic, as well as the physiological reaction of the drug towards the patient. It is the danger of fear-shock, which in pre-anæsthetic days occasionally proved fatal—and indeed may do so at the present day—which becomes most formidable when we have to decide between the use of an anæsthetic which abolishes consciousness, and an analgesic, whether local or spinal, which prevents perception of pain, but fails to remove the fear lest pain will come. While some persons experience no such dread, others faint even though no actual pain from trauma has occurred. This fact has led to many fatalities occurring under spinal anæsthesia, and has made the prognosis in the case of this method distinctly unfavourable. Recently, the plan has been adopted of combining the use of a general anæsthetic with the spinal puncture. When this is done the prognosis is distinctly better than when the spinal method is used and the patient remains conscious.

In parturition and obstetric operations, the prognosis when chloroform or ether is given is extremely favourable alike for mother and child, and is so because the conditions then existing render the depth of narcosis light. Recently, the use of nitrous oxide and oxygen has been widely advocated in these cases, but although advantages are claimed for this innovation, its safety or superiority over conventional methods are not such as to give it a prior claim to adoption so far as prognosis is concerned.

The Twilight Sleep Method.—The employment of scopolamine or morphine following the *dämmerschlaf* method of Gauss does not afford a safer plan than the judicious use

of chloroform. The prognosis for the woman is fair, but that for the child is less favourable, and unless skilled hands carry out this tedious procedure, the prognosis is not such as should encourage its use.

A remarkable example of the interaction of the nervous system on the induction of anæsthesia has been made evident during the recent war by the experience of giving anæsthetics to wounded soldiers. The phenomena occur mostly in the cases of shell shock and neurasthenia, but they also develop when these conditions are absent. The men are usually terrified, struggle maniacally, and require a greater amount of anæsthetic than is usual for persons of their weight and physique. But the fact which makes prognosis more grave in this case is that both heart failure (? cardiac inhibition) and respiratory spasm, leading to cessation of pulmonary ventilation, are frequent in their occurrence. These grave complications occur even in the hands of expert anæsthetists who have been careful to avoid overdosage—i.e., giving an amount of a drug, or a percentage strength of a drug, which would in ordinary circumstances cause danger. Here is a distinct type of person for whom the prognosis is unfavourable. The type in its manifestations resembles those classed as neurasthenics, the 'highly nervous', alcoholic degenerates, and those subject to sudden death through trivial exciting causes as in status lymphaticus, hyperthyroidism, and its congeners.

AFTER-EFFECTS.—The problem before us has to be studied from yet a further aspect. The dangers connected with either anæsthesia or analgesia are not ended when the operation has been completed. The after-effects, both mental and bodily, may either prejudice convalescence, or produce actual and grave pathological conditions such as mania, or pulmonary, or renal, or hepatic lesions; and these may ultimately prove fatal.

Having considered these general aspects of the subject, it remains to discuss those factors which we have shown to make for the incidence of danger or its avoidance, to indicate how far these dangers can be foreseen, and to point out by what means they can be best prevented or mitigated.

The factors making for safety or danger during anæsthesia or analgesia are:—

1. (a) The anæsthetic, or (b) the analgesic itself.
2. The method of employment.
3. The experience and knowledge of the person giving the drug.
4. The condition of the patient.
5. The nature and duration of the operation, and the intercurrent conditions, such as trauma, and the shock arising as a result thereof.
6. Post-operative effects.

1a. Anæsthetics.—The chemical and physical properties of the known anæsthetics determine the following law as regards their safety or the reverse: All drugs containing one of the haloid elements—chlorine, bromine, iodine—which are protoplasm poisons, are more dangerous than those in which the haloid is either absent or replaced by oxygen. The danger increases directly with the amount of the chlorine, etc., present. The lower the boiling-point and the greater the specific gravity of the liquid, the greater the danger. The gaseous anæsthetic is safer than the liquid, and the liquid than the solid—a law which follows from the preceding one asserting the greater safety of the highly volatile over the less volatile drug. These facts have been demonstrated, not only by experiment upon the lower animals, but also by clinical observation.

Hence we should expect that the order of safety of the commoner anæsthetics would be as follows: nitrous oxide; ether; ethyl chloride; chloroform; ethyl bromide. Clinically, we find that for normal subjects this order is correct; while experimentally we obtain practically identical results. As pointed out in an earlier paragraph, the incidence of death is: chloroform, 1 in 3000; ethyl chloride, 1 in 13,000; ether, 1 in 23,000; nitrous oxide, 1 in 200,000; mixtures of nitrous oxide and oxygen, uncertain, but a very low rate prevails. The figures given for nitrous oxide and its mixture with oxygen apply only to cases in which this anæsthetic is employed in minor surgery; when it is used for prolonged periods for major surgery it is far less safe, but we have no complete collection of statistics. These figures, however, cannot be accepted as being more than rough approximations. In the case of ethyl chloride the estimate given is probably much too favourable to that anæsthetic.

Waller's experiments concerning the effect of chloroform and of ether upon nerve tissue led him to believe that the former was seven times more dangerous. This is important, as deaths due to anæsthetics, when they arise from overdosage—as opposed to what may be called mechanical conditions—are brought about mainly through the poisoning of the centres in the medulla oblongata. But, as has been pointed out above, the incidence of death is largely dependent upon the condition of the patient being such as to be affected adversely by particular anæsthetics; and so it is necessary to consider briefly what are the distinguishing actions of the commoner anæsthetics, and their bearing upon pathological lesions of the systems concerned with the processes of life.

Chloroform produces hæmolysis—as does ethyl chloride in a less degree; chloroform also diminishes the activity of glandular epithelium, and ultimately acts as a protoplasm poison, destroying tissue life. Its effects upon the tissues vary directly with the nature of the latter; thus, nervous tissues suffer most, the heart muscle more than the voluntary muscles, and the latter more than the involuntary; the liver is the most vulnerable of the viscera, then the kidneys. This is, perhaps, best understood by stating that if the various tissues are subjected to chloroform-containing fluids, the percentage strength required, firstly to inhibit function, and ultimately to destroy the tissues' power of functioning, is lowest in the case of the highly-organized tissues such as nerve-cells and fibres, while in the case of other tissues, higher and higher strengths or percentage values have to be used to inhibit or destroy. The effects of chloroform are commonly misunderstood and too grave a prognosis is given. Thus in the U.S.A. it is seldom used, and many surgeons denounce its employment as unjustifiable. This arises through the intensive effects of chloroform, which are really toxic, being accepted as the same as the effects produced when merely anæsthesia is aimed at. In concentration chloroform damages tissues, in dilution it merely inhibits tissue vital activity. It is this poisoning which is called acidosis or delayed chloroform poisoning, a condition considered below. Although the most powerful of anæsthetics, and therefore the most capable of damaging the patient, the prognosis in the case of chloroform may be quite favourable provided it is properly given by an efficient administrator to a suitable subject. The types of cases in which the prognosis in the case of chloroform is bad are: anæmia, septicæmia, fatty degeneration, status lymphaticus, recent shock. Crile has shown that catharsis and starving a patient before the anæsthetic markedly lessen the alkaline reserve, and so chloroform by its presumed power of increasing the acidosis would increase the risk of patients already in a state of lessened alkaline reserve. Hence diabetics afford a grave prognosis under this anæsthetic. Levy has also pointed out that all conditions which lead to adrenalism are dangerous with chloroform. Again, blood-pressure always drops and some dilatation of the heart occurs with chloroform, the extent of which varies directly as the concentration of the vapour inhaled, so that persons with a dilated atonic heart or subnormal blood-pressure afford a poor prognosis. Gwathmey's experiments appear to indicate that chloroform vapour, when warmed, is 2·5 times less toxic than when inhaled cold. The elimination of chloroform is comparatively slow, and any interference with the functional activity of the usual emunctories such as progressively occurs as chloroform inhibits their action more and more, tends to the accumulation of the anæsthetic, and its storing up in the tissues, with disastrous effects. When, however, care is taken to avoid such a strength of vapour as produces this inhibition of tissue function, this danger is avoided. The dominating features of the action of chloroform are: depression of the activity of the heart, lowering of blood-pressure, and lessening of pulmonary ventilation and so of gaseous interchange during respiration. All these effects are progressive, but, being a function of the strength or percentage value of the vapour employed, are more or less under the control of the administrator, as he can and should lessen the strength of the vapour inhaled after induction is complete, and throughout the maintenance of anæsthesia.

Ethyl chloride and ethyl bromide, so far as we know, behave similarly; but as they are seldom employed for any but brief periods, little is definitely known of their prolonged effects. Embley estimates the toxicity of ethyl chloride when considerably diluted as $\frac{1}{19}$ that of chloroform, but when used in a concentrated form as 10 to 20 times more dangerous. Cardiac inhibition and syncope are more liable to occur; but as these complications appear early in the narcosis and before the myocardiac tissues are intoxicated, the heart usually escapes and recovery occurs. During its prolonged use, i.e., throughout

a surgical operation, the additional danger of respiratory paralysis arises. The prognosis in the case of its use for brief operations, when one or two doses only are required and when air dilution is ample, is therefore better than that of chloroform, worse than that of ether; but even in such cases the possibility of the occurrence of syncope has to be reckoned with. In prolonged cases the prognosis is bad. Used before ether, ethyl chloride is comparatively safe. As ethyl chloride is far more volatile than chloroform, the prognosis is more favourable in the case of the former than of the latter.

The prognosis of cases in which ethyl bromide and all anæsthetic mixtures containing bromine are given is extremely bad.

Ether causes hæmolysis, but unless asphyxial complications are permitted its effect is slight in this direction. It stimulates all the cells except those concerned in the urinary function. The secretions of the mouth and respiratory tract are markedly increased. In the amounts employed in anæsthesia, it produces at first excitation of function, and then inhibition, but not destruction, of the protoplasm. Hence, even if the inhibition is permitted to extend to a dangerous degree, the tissues recover their power of function when favourable conditions are re-established. Ether acts powerfully upon bacteria. It possesses a great avidity for fatty material, and, so it is believed upon experimental evidence, tends to destroy phagocytes by damaging their essential fatty environment; hence phagocytosis is said to be lessened or destroyed until the ether is eliminated and the phagocytes are able to re-assert their function. The recent work of F. C. Mann, however, throws doubt upon Graham's results, for he states that in experiments with ether, lasting five to six hours, he could detect no loss of phagocytosis. Owing to its ready volatilization, ether rapidly dissociates itself from the tissues; its elimination requires considerable absorption of heat, and hence it occasions a fall of body temperature. It certainly causes some tissue irritation, revealing itself in catarrhal conditions; especially is this so in the case of the lungs and kidneys. The extent of this action, so far as the renal structures are concerned, was investigated by me with the aid of Dr. Goodman Levy, and the conclusion at which we arrived was that, provided the amount of ether perfusing the renal vessels was not excessive, interference with function was slight. The comparison of chloroform and ether in this connection is valuable. The former anæsthetic is less prone to initiate albuminuria, although more apt to increase its amount if pre-existing. Ultimately, chloroform tends to cause necrobiosis of renal epithelium, while ether does not; though it must be admitted that this deleterious result only follows excessive quantities of the former anæsthetic. As ether increases the activity of the circulation and speeds up the heart, it induces an increase of blood-pressure. In this way the prognosis of ether, although in most cases favourable, is less so when there exists disease of the heart or arteries, e.g., arteriosclerosis, since it increases the danger of rupture of a cerebral or other vessel.

The prognosis in the case of ether depends very largely upon: (i) Its alleged damage to the respiratory function and tissues; and (ii) Its tendency to over-stimulate the central nervous system.

i. *Pulmonary Effects*.—Ether, when used without atropine having been given previously to its administration, produces salivation and increases secretion from the bronchial mucous membrane. This may cause complete water-logging of the lungs and seriously endanger life during the narcosis. The buccal secretions may be swallowed, causing prolonged vomiting, or may enter the lungs, causing infection. Ether pneumonia is a rare disease, but may occur. The congestion of the pulmonary area is usually the result of causes other than ether, such as tight bandaging. Many cases reported as ether pneumonia are really, as Dr. William Pasteur has pointed out, instances of massive collapse of the lungs due to trauma. The post-operative effects have been recently closely studied. M. S. Pembrey and F. E. Shipway contend that pulmonary complications are lessened or removed by warming the ether vapour before it is inhaled. B. F. Davis and F. B. MacCarthy³ do not accept this view, since they contend that during the passage of the anæsthetic through the oronasal passages it is sufficiently warmed. The possible danger of hyperthermia is advanced, and it is true that two deaths from this condition are on record. On the other hand, patients suffering from severe shock, or whose condition is extremely feeble, cannot warm the vapour by their own tissues, and if they do so it is at the expense of their vitality. Personally, for all asthenic subjects I believe that warmed

vapour, provided the warming is controlled by thermometric readings, improves the prognosis. Låwen⁴ denies that warmed ether vapour really safeguards from the risk of ether pneumonia. Dr. Isabella Herb has collected 30,000 cases of 'open' 'cold' ether, and found few cases of local irritation or chest complications. Graves, using a paper cone with gauze in the apex, reports 37 chest complications and 2 deaths, a death-rate of 0.05 per cent and a morbidity-ratio of 0.92 per cent; Risley reports 1920 cases, 27 chests, and 2 deaths, giving a death-rate of 0.1 per cent and morbidity of 1.4 per cent. Munroe, with open drop ether, gives 1000 cases, 15 chests, and 2 deaths, i.e., a death-rate of 0.2 per cent and a morbidity-rate of 1.5 per cent. In the first series the anæsthetic was given by students, but under the supervision of experts; in the latter two series by internes. Graves has analyzed 2000 other cases, and found that chest troubles after ether were 10 times more frequent after laparotomies than in other cases, but were less common in pelvic than in abdominal cases. In extra-abdominal operations (920) there were 2 chests. Kronlein reports 1409 cases where the open drop ether method was adopted by trained anæsthetists; the mortality due to chest complication was 0.56 per cent. The prognosis of ether judged by these figures is less favourable than is commonly accepted, but becomes decidedly better when ether is given with atropine, and possibly with highly-purified and prepared ether. Compared with local and spinal methods, ether still remains the safest anæsthetic, provided it is not given to patients whose condition is obviously contra-indicative.

The prognosis of ether given by the more recondite methods calls for some comment. We do not possess full statistics of the results in the endotracheal method. It was widely employed during the war, and in cases of jaw injury and chest and air-passage surgery answered well, but few deaths being reported. In general, warmed clean ether vapour was used with good results. Meltzer, from his extensive experiments upon dogs, found that unwarmed vapour did not produce irritation, and in septic cases its employment was a great safeguard against infection from the oral, pharyngeal, and laryngeal cavities.

Conrad Georg, investigating the pathological changes in the lungs after prolonged endotracheal etherization, found that emphysema and interference with the circulation of the lungs were the chief dangers. These are largely a question of poor technique, so that provided the anæsthetist is conversant with the method they should not arise, and hence in the hands of experts in the use of this method the prognosis should be extremely favourable.

Open ether has undoubtedly led to many fatalities; probably its prognosis is less good than that in the case of the method in which a sequence is adopted, and the ether is given by a closed inhaler of the blow-over or draw-over type. The irregularity of the strength of vapour is unfavourable, and is very common, since the true drop method is seldom pursued.

The tension of vapour employed is usually inadequate unless the 'open' is changed from time to time to a closed or semi-closed method by giving massive doses of ether or covering the mask with a towel. Professor Yandell Henderson has shown by experiment that the carbon dioxide of the blood is profoundly affected under ether narcosis. This depends upon the changes superinduced in the respiration. In profound etherization the respiration is depressed and the carbon dioxide capacity (i.e., alkali reserve) is increased. If hyperpnœa is developed, the drop in this capacity is rapid, and if below the level of 33 to 36 volumes it is not reversible and death occurs, although such fatality is not due to acidosis. Hence, irregular respiration and an uneven grade of pressure are serious factors so far as the chances of the patient's recovery are concerned. The tension of the ether vapour, again, is another factor in studying the prognosis. As F. C. Mann has pointed out, 36 is the lowest suitable for operative work; between 36 and 45 is the safety zone; between 45 and 60 danger is imminent; and above this point death may occur.

As regards the intravenous, colonic, and rectal etherization methods, we do not possess any record of a sufficient number of cases to assist us in arriving at the expectancy of life during such procedure. They all introduce complications and extraneous sources of danger which probably make them slightly more dangerous than routine methods of etherization, and certainly demand special knowledge and skill in their technique.

Epstein's statement that the bulk of the blood is lessened in etherization does not affect the question we are considering, as it is probable that any concentration which may

occur is in fact due to extraneous rather than to ether conditions. This is confirmed by his statement that the length of the narcosis is not a factor in producing the result.

ii. *Effects on Central Nervous System.*—Under this head we have to consider that the artificial raising of blood-pressure due to the stimulation of ether, when the full effect of the anæsthetic is maintained, is followed by a severe and prolonged fall of blood-pressure as soon as the ether inhalation is stopped. The greater the initial rise the greater the consequent fall. This is due to exhaustion of the centres in the central nervous systems, and not, as in the like condition under chloroform, to inhibition of function, itself restful to the nerve-cells. The recovery of collapse from this declension of pressure is far more rapid with chloroform than with ether. Indeed the depression in the latter case, associated as it is with the surgical shock—which last may be, and usually is, masked by the ether effects, and only reveals itself when the ether is no longer stimulating the control centres—may prove fatal. In such cases the prognosis is extremely grave, especially if the restorative measures adopted consist of further attempted stimulation.

Nitrous oxide resembles ether in its stimulating action upon the tissues. This is followed by inhibition of function. It unquestionably possesses a specific action,* and does not superinduce unconsciousness either by depriving the tissues of oxygen, or by splitting up and causing superoxidation (apnœa). As to some extent it replaces oxygen in the hæmoglobin of the erythrocytes, and probably in the fixed cells, its effect is commonly associated with a superadded asphyxial effect. This, however, is concomitant rather than essential, so that when it is obviated, the power of nitrous oxide to induce insentience is in no way hindered. It would thus appear that this anæsthetic, when used for brief periods and when complete exclusion of asphyxial symptoms, cyanosis, and so on, is prevented, has an extremely favourable prognosis. In cases in which excessively high blood-pressure exists, or where there is marked impediment to respiration, e.g., in angina Ludovici, its use would have a serious prognosis.

MIXTURES OF ANÆSTHETICS, such as the A.C. (1 volume of alcohol to 9 of chloroform), the C.E. (2 of chloroform to 3 of ether†), and the A.C.E. (1 of alcohol, 2 of chloroform, and 3 of ether), act variously and variedly according as they are administered by one method or another. In hot weather, chloroform and ether mixtures given by an open method produce mainly an ether effect at first, and later a chloroform effect. A closed or semi-closed method promotes a chloroform effect, modified by the dilution due to the other ingredients of the mixture. It is not safe to assume that true antagonism exists in such mixtures, since the component anæsthetics evaporate individually and at different temperatures. Further, they possess a various coefficient of 'spread' when sprinkled upon an absorbent surface such as lint or gauze, and the rate of evaporation may be taken roughly as varying directly as the spread and inversely as the wetting. While the heavier vapours, such as chloroform and its mixtures, sink towards the reclining patient, the lighter rise and escape into the atmosphere of the room. Sharpey-Schäfer, however, has demonstrated that the alcohol-chloroform mixture is, in fact, more stable, so that a certain amount of antagonism is existent. This was assumed in the case of the A.C.E. mixture also, and it is probably true, though to a less extent, although the ether component in this case acts as a diluent, not as an antagonist, to the chloroform. It will be observed that when alcohol, ether, and chloroform are shaken together, heat is generated, a fact which appears to indicate a more intimate association than exists in simple solutions. In the case of mixtures, the risk to life—i.e., the prognosis—is influenced more by such extraneous conditioning factors as temperature, method of administration, amplitude of respiratory movements, and thorough admixture with air, than in the case of single anæsthetics. This is because no administrator can be sure what is the actual percentage strength of chloroform vapour being inhaled at any given moment.

The employment of *mixtures of the vapours* themselves, by some method such as that suggested by Gwathmey, Shipway, and others, removes many of these objections. Such elaborations as Schleich's or Wertheim's solutions are too infrequently employed to need analysis,

* See papers on "The Physiological Action of Nitrous Oxide" by the present writer in the *Proceedings of the Odontological Society*, vols. xviii, xix.

† There are several varieties of this mixture in use besides that named. For example: 1 volume of chloroform to 2 of ether; equal volumes of chloroform and ether; 1 volume of chloroform to 2 of ether.

The prognosis in the use of the C.E. mixture is practically that of chloroform, or perhaps of that anæsthetic slightly diluted, and the same applies to the A.C.E. If such mixtures are used by a semi-open or closed method, a risk to life is incurred. All chloroform-containing mixtures, and chloroform itself, are most dangerous when used for induction of anæsthesia; if the induction is made by other means, and chloroform is only used for maintenance, the prognosis becomes much more favourable.

Gaseous mixtures, such as that of nitrous oxide and air or oxygen, fall into another category. Here the oxygen or air merely supplies the necessary aeration and so obviates tissue asphyxia, hence permitting extensive employment of nitrous-oxide gas. The hyperpnœa so commonly existent with the methods employed lessens the carbon-dioxide content of the blood, leading to acapnic conditions, so that the addition of carbon dioxide gas to the nitrous-oxide-oxygen mixture finds favour with some persons, and is employed for prolonged operations. The simplest method of supplying carbon dioxide is by allowing *partial re-breathing*, and this is provided for by Teter and others in their apparatus for prolonged administration of these gases for the purposes of major surgery.

Nitrous Oxide and Oxygen in Major Surgery.—The prognosis when this method is adopted is far less favourable than its sponsors have in the past claimed for it. J. F. Baldwin⁵ has collected statistics of deaths in the U.S.A. which demonstrate a very high mortality-rate. In 1200 or 1300 observed cases, this writer states that the mortality in major operations was 1 per cent. The large number of deaths he records in his paper occurred when the anæsthetic was given by men possessed of expert knowledge and wide experience in its use. The deaths appear to have been mainly due to heart failure, and not, as is commonly taught, to gradual asphyxia. There seems little doubt that the cardiac collapse which occurred was led up to by the abnormal condition of the blood in the pulmonary circulation, which imposed a stress upon the heart which it could not withstand. The method would, therefore, prove peculiarly perilous for patients with various heart conditions such as would weaken the resiliency of the organ. This method has received increased study both in this country and in the U.S.A. During the war the nitrous oxide and oxygen mixture was extensively used for shock and other cases. All the results obtained were said to be good, although some fatalities occurred. No sufficient statistics are obtainable, so that the prognosis, except for cases when other anæsthetics were ruled out, cannot be given. In a percentage of cases, ether or the C.E. mixture was resorted to, to deepen the narcosis or remove muscular rigidity. H. E. G. Boyle considers the method valuable, and supplies the statistics of 711 cases. Of these, 5 had bronchitis, and 1 of these bronchopneumonia; 38 per cent had some ether or C.E. mixture, and 2 pure chloroform; 20 vomited, but only 3 badly; there were no deaths. The method must be considered upon its trial, and, except in the hands of experts, it is too difficult for prolonged or difficult cases.

The number of fatalities cited above makes it evident that at present the prognosis is not very favourable.

Such combinations as amyl nitrite and chloroform, somnoform (ethyl chloride, methyl chloride, and ethyl bromide), and ethyloform, a more dangerous variant of the last, need merely to be mentioned as extremely unsatisfactory agents.

ALKALOIDAL BODIES USED IN ASSOCIATION WITH GENERAL ANÆSTHETICS.—Those most commonly in use are atropine, morphine, scopolamine, omnopon, strychnine. We may add chlorbutyl, although it is not alkaloidal.

Atropine.—The use of this drug, $\frac{1}{100}$ gr., given hypodermically one hour before inhaling an anæsthetic, has revolutionized the methods of etherization. Its action checks the excessive secretion of the buccal and respiratory areas, and so removes one of the great drawbacks of ether. The dose has to be varied according to circumstances. In some persons, persistent throat dryness follows its use. Children, as a rule, tolerate atropine well. A further advantage of atropine is that it lessens the irritability of the pneumogastric nerves (Sharpey-Schäfer), and so minimizes the danger of vagal inhibition of the heart under chloroform. Hoelscher's observations appear to prove that much of the post-anæsthetic chest trouble is due to the aspiration into the air-passages of saliva and mucus impregnated with the anæsthetic; hence, lessening this secretion by atropine diminishes this risk; further, since the swallowing of the mucus together with the

condensed vapour of the anæsthetic promotes a catarrhal condition of the stomach and causes vomiting, atropine lessens sickness. Although atropine materially lessens the nausea and vomiting due to the anæsthetic, it fails in a few cases, especially if sepsis is present. The prognosis of ether inhalation is certainly better when atropine has been used concurrently.

Morphine, Scopolamine.—There can be no question that although morphine and atropine are commonly employed together, these drugs act better and more safely when combined with scopolamine. During the Franco-Prussian war the mixture of morphine and atropine was in extensive employment, but was discontinued, as the prognosis was bad owing to the frequency of respiratory collapse. This, however, was in the case of chloroform. The pharmacological law which recognizes that several drugs exert synergic action in some directions, while they antagonize in others, holds with regard to these alkaloids. Thus, the respiratory centre which is depressed by morphine is stimulated by the atropine bodies, while scopolamine acts concurrently with morphine in producing suspension of the consciousness. Scopolamine is a dangerous drug when used by itself; its undesirable qualities are lessened or removed, however, when it is associated with morphine and atropine. The outstanding advantages of these drugs are that they soothe the mental fear of the patient, and they lessen the amount of the general anæsthetic required. As is discussed below, the psychic factor in anæsthesia is one of great importance. The 'highly-strung' patient, the neurasthenic, the neuropath, is in some danger during induction of anæsthesia. Fear-shock is to him a grave danger. If, therefore, it is possible to obviate his terrors, the prognosis in his case is rendered more favourable. This can be done by administering a hypodermic injection of a solution which contains scopolamine $\frac{1}{100}$ gr., morphine $\frac{1}{6}$ to $\frac{1}{4}$ gr., and atropine $\frac{1}{100}$ gr. This preliminary step should be taken one hour before the anæsthetic is administered. The disadvantages are that these drugs disguise to some extent the guides to anæsthesia by interfering with pupillary phenomena; they prolong induction, as breathing is more shallow and the thoracic excursions are diminished, and they induce a prolonged and profound sleep consecutive to the operation, and this, although highly beneficial to the patient, requires special and heedful watching, lest malposition of the head, falling back of the tongue, trickling of blood into, or accumulation of mucus about, the glottis, leads to interference with respiration. Their use presupposes that the patient has been carefully examined to ascertain if there is any contra-indication to the use of morphine. In local or spinal analgesia, the use of these drugs is obviously beneficial; but it needs caution in the case of thecal injection, lest the action of the stovaine or novocain travelling somewhat high should interfere with the medullary centres already drugged by the morphine which has been injected. It is commonly asserted that the drug introduced into the theca spinalis is 'fixed' within fifteen minutes of the injection, but it is very doubtful whether such fixation does take place in all cases.

Omnopon.—The difficulty of standardizing the preparations of morphine has led to the adoption of a mixture of opium alkaloids with a morphine action, under the name of omnopon (pantopon). Dr. Sahli has shown that the chlorides of these alkaloids are capable of being standardized, and so a definite dose with a known morphine effect can, it is asserted, be obtained. This substance is employed, in a similar way to morphine, in association with other alkaloids.

The dangers of ether in the direction of pulmonary and renal sequelæ, and those of chloroform in that of cardiac enfeeblement, are diminished by using these alkaloids adjuvantly; and this is markedly so in the case of irritable heart conditions, such as different forms of tachycardia. The use of these alkaloids would increase the danger in all states in which the respiratory system is hampered, either through cerebral or circulatory causes. Hence, in operations upon the brain or spinal cord if chloroform is to be used, also in cases in which cyanosis or breathlessness is present—unless when the latter is due to cardiac instability—their use is detrimental.

When the general anæsthetic selected for a prolonged operation is nitrous oxide in combination with oxygen, it is obligatory to use the M.A.S. (i.e., morphine, atropine, and scopolamine) injection to deepen narcosis. Hence prognosis in these cases is difficult to gauge, since the respiratory centre is rendered more susceptible to the morphine action.

Strychnine is given hypodermically just before an anæsthetic with the view of

antidoting chloroform, but it does not accomplish this object ; indeed, it is probably detrimental, and when associated with morphine produces little if any beneficial effect, although it prolongs induction and causes the muscular rigidity of the patient to be emphasized. If strychnine is of any value in the small doses usually adopted, it is only in the direction of stimulating the respiration. It is very doubtful whether the use of this drug improves the prognosis.

Chlorbutyl.—Chlorbutyl (15 gr.), given ninety minutes before the anæsthetic, determines drowsiness, and certainly diminishes the risk of after-sickness.

1b. Analgesics.—The dangers of *cocaine*, both in endermic injection, intrathecal injection, and when introduced into the urethra, are so well known that most persons have relinquished its use.

Novocain is probably the safest drug for local and regional analgesia, if properly sterilized and employed with the addition of adrenalin.

Stovaine seems less employed in local analgesia, owing to its damaging effect on the tissues ; but it is certainly one of the safest of the drugs used in intrathecal injection. It produces some hæmolysis, and its use is not free from the liability of being followed by oculomotor paralysis and other dangers.

Tropacocaine and *alypin* have their advocates, but probably neither is as safe as *stovaine* for spinal analgesia. The question of combining these drugs with adrenalin is discussed under another caption (see *Methods of Employment*).

The prognosis as to danger in the use of local and spinal analgesia is extremely difficult to estimate, as so much depends upon the method employed and the condition of the patient, and these are variants in all cases. This fact renders generalization of little practical value. We know, however, that these methods, especially the intrathecal injection of drugs, have inherent sources of danger, since when the analgesic has once entered the tissues it is impossible to abrogate its action. Slight errors in technique also matter more in such procedures than in inhalational methods. Assuming experience, absolute asepsis, and careful regulation of the dose, the danger to life is probably not great in the hands of experts, and the sequelæ are not necessarily serious. It is, however, impossible, in the present state of our knowledge, to promise total immunity from them, or to forecast the degree of their severity. The prognosis of spinal anæsthesia in the case of nervous persons, neuropaths, etc., is distinctly bad, as the psychic shock is severe. It is usual now to combine light narcosis by some general anæsthetic with the intrathecal injection, and in this case the prognosis is improved.

Local analgesia in chest surgery does not give so good a prognosis as was anticipated ; indeed, Gottstein⁶ records a higher mortality when local analgesia was used than when chloroform was employed. The order of danger, in relation to prognosis, in which these drugs stand is—alypin, cocaine, tropacocaine, stovaine, novocain. In spinal injection novocain is probably less safe than stovaine. Apothetin and benzyl alcohol are stated to be safe and effectual, but there is insufficient evidence to place them in the rota of safety. It must be accepted that the addition of adrenalin to the analgesic makes the danger of its use greater.

Statistically, the death-rate under spinal analgesia is given by various authorities as follows :—

MORTALITY OF SPINAL ANALGESIA.

Reporter	Cases	Deaths
Hahn - -	708	8
Patterson - -	7807	20
Reclus - -	2000	6
Zahradnický - -	4679	12
Wainwright - -	16300	14
Strauss - -	22717	46
Total	54211	106

This gives, roughly, a mortality of 1 in 500. Too much importance must not be attached to such figures, as many of the Continental surgeons state that they have used the method in thousands of cases without a death.

The danger of mental shock incident to local and spinal analgesia cannot be overlooked. Profound physical and mental depression, and even mania, have followed these methods, although the patients felt no pain. The prognosis made upon statistics, which as has been indicated above is not wholly reliable, is less favourable when these methods are adopted than when a general anæsthetic is given.

GENERAL REVIEW OF STATISTICS.—A study of the elaborate tables and précis of fatalities issued by the British Medical Association in 1900* shows that comparatively few of the deaths, recorded with sufficient precision to admit of exact classification, are due wholly and solely to the anæsthetic. The factors adopted by the workers on this committee were—the anæsthetic, the operation, and the state of the patient at the time of the operation. Although the number of cases examined was comparatively small, 25,920, it is sufficiently large to form a fair basis for comparison. However, the last two factors, the operation and the state of the patient, which may at first sight appear to be constants, are in fact not so. This is shown by the consideration that, for patients whose bodily state is extremely unfavourable, the 'safest' anæsthetics are relied upon; so that these agents are employed under desperate circumstances, with results which give for such anæsthetics a less favourable incidence of fatality. A further point to be considered when comparing the results of general anæsthesia with spinal and local analgesia, is that whereas the statistics of the first comprise every type of administrator, including many who are quite inexperienced and even devoid of medical knowledge, the second gives the work of keen experts whose care and acumen are unquestionable and whose technique is as good as our present knowledge of analgesia permits; nor is this knowledge slight, since the stage of experimental groping has passed, and methods and technique are practically settled.

Opinions, again, are in absolute conflict about what pathological conditions contraindicate the spinal method. It may be useful to indicate briefly the consensus of views. The method is recommended in acute abdominal conditions, for operations below the umbilicus, especially in 'acute appendix' cases; also when acute or serious bronchial or pulmonary disease exists and the lungs are waterlogged; and in severe glycosuria, and gangrene of the extremities.

Whether patients with serious cardiac lesions, with excessive blood-pressure, or with pronounced albuminuria, should have the spinal method is very doubtful. The decision could only be made by scrutiny of each case. Whereas, formerly, the old and feeble, suffering from serious abdominal trouble, were regarded as good subjects for spinal methods, this view is not at present universally held. In cases of intestinal obstruction complicated with stercoraceous vomiting, the spinal method was looked to as a way out of a dangerous *impasse*. Unhappily, several deaths have occurred through fæcal drowning when spinal analgesia was obtained, the features of which were identical with those occasionally met with when general anæsthesia was adopted. When feasible, local analgesia is undoubtedly safer than is the spinal method for such patients, but it fails to remove the distress arising from handling the viscera.

If the dangers of sepsis are omitted, local analgesia offers few disqualifications, except that it is only applicable in comparatively few cases, unless we are willing to inflict a certain amount of pain, pain which is sometimes severe. Its best use is undoubtedly when combined with light narcosis, whether by alkaloids or inhalation. For attaining this end, Crile's method of *anoci-association*—i.e. the local and regional injection of analgesics, and the employment of a general anæsthetic, e.g., nitrous oxide and oxygen—gives a good prognosis. This is said to be especially the case in exophthalmic goitre. It must be remembered that persons who were subjects of the *status lymphaticus* have died when a local analgesic has been injected, even though no overdose had been given. Another danger which is not always recognized is that nervous persons, and those whose mentality is unstable, are liable not only to serious neurasthenia, but even to delusional mania, as sequelæ of a trivial operation performed under local analgesia. Also after-pain is stated to be more severe when local analgesia has been employed.

* Report of the Anæsthetics Committee appointed 1891.

To sum up : In serious conditions it is best to restrict spinal analgesia to patients who are not good subjects for the methods of general anæsthesia, unless the greater facility of obtaining muscular relaxation by the former method gives the surgeon a better chance of performing an operation in the success of which the patient's life is involved, and in these cases the prognosis is probably best when the use of a general anæsthetic is combined with the spinal method. Local analgesia, unless by regional methods, is dangerous in septic cases ; it is valuable for small and superficial operations ; its success in exophthalmic goitre is at least doubtful, unless associated with a general anæsthetic, as in Crile's method mentioned above.

2. Methods of Employment.—Since the dangers arise from over-dosage, or from using an anæsthetic by some method which embarrasses the circulation, respiration, the nerve controls, or the metabolism of a patient already suffering from disease of one or other of these systems, the method selected makes for safety if it gives the administrator absolute control of the dosage of the anæsthetic, or for danger if it fails in this regard and further imposes upon the patient an increased disability. Hence, dosimetric methods of giving chloroform, always desirable, are essential in operations upon persons with feeble circulation (cardiac disability), in cases of goitre or lymphatism, and in operations upon the central nervous system.

Suffocative conditions contra-indicate the employment of ether or nitrous oxide, since these anæsthetics provoke venous engorgement of the air-passages, as well as the adoption of closed methods. Thus, the use of nitrous oxide or ether for a patient with angina Ludovici will probably kill him, since a speedy tracheotomy under the circumstances is impossible.

Posture becomes an integral part of the method in operations upon the thorax when an abscess cavity opens into a bronchus, since turning a patient upon his sound side may lead to filling his unaffected lung with fluid.

Open-ether methods are now regarded as peculiarly safe ; but if used without atropine, they promote excessive secretion, and are apt to bring about excessive stimulation, which in its turn leads to exhaustion of the nerve centres and finally to collapse. The prognosis of ether collapse is worse than that of chloroform, but it must be clearly understood that this statement applies only to cases in which no sudden overdosage has been employed.

The use of warmed ether vapour favours the prognosis, while the adoption of the endotracheal method (for ether) for goitres, and operations on the oropharyngeal region, certainly gives a better chance of the avoidance of serious complications. Chloroform used in this way has been condemned on experimental data, but recently a small number of cases where a dosimetric system was adopted have been successful, and so far no dangers have been recorded.

Infusion methods (ether), while of great value in prolonged exhausting operations and in cases of profound blood-loss, are liable to cause œdema if excessive quantities of saline are allowed to enter the circulation.

Hedonal, when infused, unless in cranial surgery, is dangerous, since the effect persists for hours, and patients may die before the drug is eliminated ; they incur special risks from malposition in bed, and from even slight hæmorrhage, since the blood may pass into the air-passages. Such dangers are peculiarly apt to arise in all operations upon the mouth, nose, and upper air-passages. In these cases, whether chloroform, infusion of ether or hedonal, or colonic etherization is adopted, the method used must enable the patient to retain his laryngeal reflex, otherwise foreign material will invade the lungs. It is urged in favour of the insufflation and pharyngeal methods, that such an accident is impossible ; and were the technique of these plans less difficult, there is no doubt that one or the other would give the patient the best chance of avoiding these accidents.

The method of prolonged nitrous-oxide administration, with or without oxygen, whether by the nasal route or by one of the many good apparatuses provided with a safety valve, is less safe than when employed for one brief inhalation. A severe strain is imposed upon the respiration ; and the heart and blood-vessels, unless healthy, are overtaxed as the blood-pressure becomes raised.

Endotracheal insufflation, so far as we know at present, presents great possibilities ; but even slight errors of technique may cause serious interference with the pulmonary

circulation, through prolonged plus pressure being maintained in the lungs, although obviously this is not a necessity of the method.

The methods of colonic etherization are valuable, both for operations on the air-passages and on the thorax, lungs, and pleura. They prove most dangerous unless the air-ways are kept patent, and also when the colon has been weakened by disease, and especially if ulceration has existed. If liquid ether enters the bowel, serious proctitis will ensue; and excessive injection of the vapour has caused meteorism, and even rupture of the bowel. The ether-in-oil method of Gwathmey is yet on its trial; it has been recently shown to be less free from danger than was originally supposed. Patients at times remain unconscious for many hours, nor has the method been free from fatalities.

The danger of intermittent adosimetric methods in the use of chloroform has long been recognized; but recent work has shown that unless complete anæsthesia is induced, cardiac fibrillation is produced. However, chloroform given by a dosimetric system is certainly safer than when an open method is employed. The depth of narcosis can be controlled by dosimetry, since it is as easy to employ a high as a low percentage value of vapour. If experts restrict the strength to values of 2 per cent or less, it is because evidence exists which proves these values are the safest. In some instances it may be requisite to employ a vapour of higher percentage strength, but the prognosis of any strength above 2 per cent is certainly not favourable.

With regard to the methods of giving ethyl chloride, it may be said that the open plan much used by Hornibrook in Melbourne is reputed safer than closed methods. Prolonged use of this anæsthetic presents much the same dangers as does chloroform, unless careful dosage is adopted.

Spinal and Local Analgesia.—Broadly speaking, injection above the lumbar region is far more dangerous than at the place of election between the spines of the second and third, or third and fourth, lumbar vertebræ. Experience points to the danger of the method being increased if adrenalin is combined with the analgesic, and to the absence of any commensurate benefit from prolongation of the period of insensibility to pain. The relative dangers of heavy or light fluids in the use of intrathecal injection has hardly been worked out. It is assumed that the drug used is 'fixed' in the tissues in 15 to 20 minutes, and so the inverted or Trendelenburg posture is reputed to be safe, provided the head is flexed forward. The prognosis is, however, less favourable when this position is allowed in cases of spinal analgesia. In local or regional analgesia, on the other hand, adrenalin together with novocain lessens the dangers, provided the quantity of adrenalin is strictly limited. That adrenalin is a dangerous drug has been shown by Goodman Levy and others, especially when used in conjunction with cocaine in nasal surgery. This is peculiarly the case when chloroform is also used and light narcosis is maintained; cardiac fibrillation appears to occur, with a fatal result.

3. The Administrator.—This factor has been already dealt with in the first part of the article. It may be added, however, that the modern methods of producing anæsthesia have become complicated by the introduction of somewhat intricate apparatus, familiarity with the employment of which needs special and prolonged training. The administrator whose armamentarium is restricted to the older methods may be competent in their use, but his inexperience in present-time methods makes for the disadvantage of the patient and a bad prognosis in two ways. The character of the operation may demand for its ultimate and complete success that an unusual method of producing anæsthesia should be adopted. If the inexperienced man undertakes the administration, his chances of mastering the intricacies of the method are poor, while if he prefers to employ an older and less satisfactory method, he may hamper the work of the surgeon, and so produce a condition of things which does not improve the prognosis of the case.

4. The Physical and Mental State of the Patient.—

Extremes of Life.—The rule of giving chloroform to persons up to six years of age and to those over sixty is a survival of the myth that children and women in labour enjoy immunity from danger from that anæsthetic. As a matter of fact, children are peculiarly liable to danger, owing to their proneness to lymphatism and to post-operative toxæmia (delayed chloroform poisoning, or acidosis).

As regards old age, two points have to be carefully weighed. A person advanced in years must have considerable stamina to have attained his age, and so is usually a good subject. Indeed, age—and this is the second and more important point—must be reckoned less by years than by the healthiness of the tissues, especially of the lungs and blood-vessels.

To return to the question of children, it is beyond the scope of our present purpose to discuss whether lymphatism—status lymphaticus—exists as a pathological entity; it is proposed to discuss the symptoms and pathological conditions grouped under these headings and to indicate their bearing upon the question of the safety or danger of anæsthesia.

Status lymphaticus—Lymphatism.—This condition is commonly overlooked in life, but of late years post-mortem examinations have shown certain lesions, not only in infants and children, but even in older persons. The lymphatic follicles and glands throughout the body are enlarged, the heart is commonly small, and the aorta is sometimes markedly diminished in calibre. The chronic enlargement of the tonsils and the presence of post-nasal adenoid growths produce imperfect pulmonary ventilation, so that the child suffers from lack of complete aeration of its blood and tissues. There is frequently a persistent thymus, but it is very doubtful whether this, save in most exceptional cases, can cause mechanical interference with breathing. Its presence may be seen sometimes as a shadow in a skiagram, though the absence of the shadow does not disprove its presence. Some enlargement of the thyroid gland is present in about 50 per cent of the cases examined. It is believed by some authorities that the condition is associated with a toxæmia, due to internal secretion of the ductless glands, which renders the heart peculiarly liable to failure. The fat of the body is increased, the skin is said to be harsh and liable to pigmentation, and the mental outlook is perverse; thus, although the child is often mentally bright, he is irritable, easily annoyed, and incapable of much self-control or prolonged exertion; hebetude and introspection focus his mental attitude. Clinically, the dominating symptom is the appalling liability to sudden death from heart failure without adequate cause. The prick of a hypodermic needle, the entry into a bath, sudden cold, may claim him as a victim. Into this group come infantilism, cretinism, and cognate conditions.

There seems little doubt that although the incidence of deaths associated with this condition is small when compared with the incidence from other states, yet, given a pronounced case of lymphatism, the danger incidence is great, the catastrophe ensuing upon mental shock, fear, pain, or overdosage. The chief danger appears to arise in the large number of cases which show no marked symptoms in life; nor can one say definitely that every case of a child with enlarged hypertrophied tonsils and glands may not belong to the type, even though his symptoms are ill-defined. That thousands of such children pass through the ordeal of anæsthesia without scathe goes without saying, while we know that the use of a local analgesic (tropacocaine) in a usually safe dose has been associated with the death of a lymphatic patient. It must be borne in mind that one type of lymphatic patient is marked by respiratory danger, the other by circulatory catastrophe. The 'sudden death' of the German writers is designated *white death*, while the less sudden fatality of primary respiratory origin is known as *blue death*.

It is probable that, in estimating the share of danger from the anæsthetic, we have to consider not only whether one or another drug is more dangerous, but whether, owing to the dyscrasia, all drugs are dangerous unless we are keenly alive to the fact that such delicate persons cannot withstand the same doses and concentrations of anæsthetics as are well within the zone of safety for the ordinary individual. It is less that the anæsthetic is dangerous, than that it is the way the anæsthetic is presented to the lymphatic patient, which courts disaster. Although chloroform is associated with a majority of these deaths, it is not proved that it is, indeed, the most perilous. It must be remembered that chloroform is the anæsthetic of choice and the one most usually employed for young persons and for operations upon the upper respiratory tract, and that it is such persons who suffer from lymphatism and usually require this type of operation. It is, however, probable that chloroform is dangerous in status lymphaticus owing to the fall of blood-pressure it entails, since it is this decline in blood-pressure which is peculiarly prone to cause death in such cases. When an inexperienced anæsthetist is administering the anæsthetic, ether or an ether mixture is safer, and offers the best chance of success;

but it should be given after a hypodermic injection of atropine. Death associated with lymphatism has occurred during the use of most of the general anæsthetics, and even when local analgesia has been adopted. Where chloroform is selected, it should be given in the mixture containing one volume of alcohol to nine volumes of chloroform, with high dilution of air or, better, of oxygen, and complete anæsthesia should be obtained before the operation is commenced. It adds to the patient's safety if all asphyxial complications, fear, and roughness are rigidly prevented.

Acidosis (conventionally so-called)—*Post-operative Toxæmia—Delayed Chloroform Poisoning*.—Deaths following what appeared to have been a normal anæsthesia, obtained by chloroform, by ether, by ethyl chloride, or by a mixture of these, have been imputed to the prolonged effect of the anæsthetic upon the glandular structure of the liver and the kidneys, as well as on the muscular structure of the heart. The onset of events is marked by uncontrollable vomiting between the twelfth and forty-second hours after the inhalation; the vomit is foul and watery, greenish in colour at first, but brown later. There is marked restlessness or delirium, with intervals in which the patient is apathetic, and this apathy may end in fatal coma. The urine is scanty, and commonly contains albumin and diacetic or β -oxybutyric acid. The breath has the apple-like smell of acetone. The patients are usually young, commonly poorly-nourished infants or children; neither the gravity of the operation nor the duration of the anæsthesia appears to count.

In a large number of patients whose urine was examined before the anæsthesia and subsequently to the operation, diacetic acid was found to be present before operation, and only a few of these developed severe symptoms. Indeed, it has been demonstrated that mere change of dietary, restriction (starvation) or improved feeding, is associated with diacetonuria. The pathology of the condition is certainly obscure, and not a few instances of septic changes in the organs have been advanced as cases of 'delayed chloroform poisoning'. Opie, indeed, has produced fatty changes similar to what is described as 'delayed chloroform poisoning', by means of bacteria (*B. coli* and *Streptococcus pyogenes*). On the other hand, Leonard Guthrie and others have certainly demonstrated that the lesions—destruction of the glycogenic function of the liver, degeneration of the parenchymatous tissues of many organs, and marked fatty degeneration in the organs of the alimentary tract—occur without the incidence of sepsis, syphilis, or other distinctive disease. Association with cyclic vomiting has been suggested, but although probable, it cannot be considered proved. Most authorities agree that perversion of the hepatic function leads to failure of metabolism of carbohydrate foods, consequent upon which is destruction of glycogen and some damage to the tissues, with liberation of fatty acids. The condition is, however, uncommon, and even those who have had wide hospital experience have seen few cases, unless we group all patients who incur prolonged post-operative vomiting as suffering from the appalling perversion of metabolism witnessed in acidosis. That the anæsthetic is but one factor in producing this toxæmia is obvious, but that it may act in this way is equally certain. Experiments on the lower animals have demonstrated that repeated inhalation of anæsthetics, and excessive strength of their vapours, as well as accumulation of the anæsthetic in the tissues, produce destructive tissue effects quite similar to those described above. The association of this toxæmia with diabetes and glycosuria is more than probable.

To estimate the prognosis is difficult, since we cannot be sure that children with normal urine will not subsequently develop acidosis; but when they are weakly, have suffered from cyclic vomiting, are febrile, and presumably suffer from sepsis, it is certainly grave unless the anæsthetic can be postponed for a few days and the carbohydrate deficiency counteracted by rectal injections of dextrose or glucose. Such rectal feeding (glucose 1 oz. in saline 6 oz.), given every three or four hours, is excellent both before the anæsthesia and as soon as the vomiting appears. It has been suggested that the intravenous infusion of saline containing 6 per cent of dextrose offers even a better means of supplying the requirements of the organism. Whether the commonly adopted method of introducing large quantities of alkalis is of much value is open to question; it does no harm, but at best it is only treating a symptom, and not removing the cause of the pathological perversion of metabolism. As has been stated above, diacetic acid is too commonly present in the urine of all patients for its discovery before operation to veto the employment of an anæsthetic, although it would indicate the selection of ether, if that agent is otherwise

appropriate, and enforce the necessity for careful limitation of the quantity of the anæsthetic given.

Beesly has pointed out that acetonuria is virtually always present in the cases which are septic, but that chloroform increases the danger of fatality. In 19 appendix abscess cases when chloroform was given, 14 died; in 24 when ether was administered, 2 died. It must be borne in mind that acidosis is the result of many conditions, and so these have to be differentiated. Thus, it may be (a) symptomatic; (b) due to the use of various drugs; (c) associated with diabetes; (d) associated with cyclic vomiting; (e) associated with inhalation of chloroform, and to a less degree with that of other anæsthetics, e.g., anæsthohol (Torek); (f) associated, as it commonly is, with infancy. (*See also pp. 6, 69.*)

Anæmia, whether it be accepted as merely symptomatic of physical depression or not, is a very important factor in estimating the dangers of general anæsthetics. It is stated that when the hæmoglobin falls below 50 per cent of its normal, chloroform, and even ether, become dangerous; Mickulicz accepts 30 per cent below normal as dangerous. Yet the danger of *operating* when the hæmoglobin content is unduly low does not impress those who see such perils lurking in hæmolysis produced by anæsthetics—for hæmolysis certainly occurs as a result of trauma *per se*. It is probable that Snow's dictum is correct, and that when a patient is judged to be fit to undergo an operation, he is also fit to be subjected to anæsthesia. The main points which need attention are—the limitation of the amount of the anæsthetic which is given, and the careful selection of the method. Hæmolysis is less, of course, when analgesia is employed; and if the condition of the poorly-nourished nervous system is deemed to be satisfactory, the spinal method or local analgesia should replace inhalation. There is, however, a risk in these cases, too often ignored, of the supervention of psychic shock and consequent circulatory catastrophe. The importance of estimating the hæmoglobin as a test as to the operability—and this of course carries with it the safety of giving an anæsthetic—in the case of shocked and wounded men in warfare is considered in another section.

The danger of chronic, as opposed to acute, anæmia is greater, especially if the blood drain in the latter case is due to repeated and severe hæmorrhages, such as occur in metrorrhagia. In the first case, behind the condition is some serious dyscrasia, probably a perversion of the blood itself; in the latter, it is a mere temporary numerical loss of erythrocytes. When the surgical aspect of the case permits of delay, pre-operation treatment is advisable, and especially is this the case with young persons. An infusion method offers us the obvious advantage in these cases of combining anæsthesia with a supply of a physiological fluid which is competent to counteract the deleterious depletion of the circulating fluid.

Exophthalmic Goitre.—The incidence of danger in these cases is commonly considered to be so great, that many continental authorities, who suffer an experience of somewhat crude methods of anæsthetizing, discountenance the use of general anæsthesia, substituting a local analgesia. But danger is not obviated by this procedure, since psychic shock is not removed, and it is this condition which makes for a fatal result. Unless the elaborate method of Crile, 'stealing the thyroid', is adopted, and local analgesia is combined with the employment of both hypnotics (scopolamine, morphine, and atropine) and the nitrous-oxide-oxygen mixture, we have to decide whether chloroform or ether should be employed. Crile's method, unless carried out in its entirety and to the last detail, is not satisfactory; and in this country it is difficult to isolate a patient from her friends, to maintain the mystery as to the date of operation, and ultimately to perform it without a formal consent. A fatal result, which is always possible, would give rise to grave questions of responsibility which needs must be carefully faced beforehand.

The choice of the anæsthetic resolves itself into that of the method. Undoubtedly a preliminary drowsing with suitable hypnotics is advisable, whether local or general methods are pursued. Local systems are admitted to fail to relieve pain and the concomitant reflexes when the thyroid is being dislocated, and this fact increases the danger. Chloroform with oxygen is only safe when a dosimetric method is employed, as a serious fall of blood-pressure spells disaster. Ether, even if guarded by atropine and given by an open method, often causes dyspnœa in goitre cases, owing to the large excess of bronchial secretion it excites. It has a further disadvantage in that its stimulating effect cloaks the signs of shock, and often leads to the performance of a more extensive operation

than the patient can bear. As soon as the ether effect has passed, profound collapse sets in, and death is liable to occur. This calamity is especially likely to ensue when ether has been given in unstinted quantity, as by the open method.

In ordinary parenchymatous goitres, the atropine and warmed-ether method in the hands of an expert gives a fair prognosis provided the narcosis is maintained at a low degree after the skin incision is made and the tumour is dislocated from its bed. Intra-tracheal etherization has given good results both in simple and in exophthalmic cases, and offers a good prognosis—that is, if the amount and pressure of ether given are kept low. Upon the whole, the prognosis with atropine and ether in these cases is better than that when local medication or chloroform is employed.

Serious Lesions of the Nervous, Pulmonary, Circulatory, Renal, or Metabolic Systems.—In estimating the incidence of fatality among patients suffering from the above, we have to consider, less the actual disease, than the effects which it has brought about in the physical well-being of the patient. If, in the case of disease of the nervous system, we recognize that there is, or may be, pressure about the pons Varolii or the medullary centres, we know that any profound narcotization of the respiratory centre will make for extreme danger. Thus, the prognosis in cases of cerebellar tumour, when much pressure exists, is bad, while that in cases of cerebral tumour and spinal disease needing laminectomy is serious—proportionately so according to the height of the segment of the cord which is subjected to pressure. The danger is probably less when chloroform is employed than when ether is used. Again, when well-marked arteriosclerosis exists, there can be no doubt of the danger of using a general anæsthetic given by any method which involves rise of blood-pressure, since it promotes a grave risk of a cerebral hæmorrhage. Three conditions of blood-pressure give an unfavourable prognosis: (1) Unstable conditions of the circulation, such as arise in children, in exophthalmic goitre, in the anæmias, and also in severe neurasthenia; (2) Excessively low blood-pressure, found in prolonged wasting disease, after severe hæmorrhages, and during traumatic shock; (3) Extremely high blood-pressure. In conditions (1) and (2) the prognosis is fairly good if ether can be given, especially in association with oxygen, while asphyxial complications are absent. In (3) the danger to life is greater when ether or nitrous oxide is used, and when the blood-pressure is still further raised by such conditions as interference with respiration. Apoplexy has frequently occurred as a result of these anæsthetics being given. Equally perilous in cases of advanced pulmonary, bronchial, or pleuritic disease would it be to employ an anæsthetic which would increase respiratory difficulty, and so throw strain upon a heart probably taxed already to its utmost capacity. A mere cardiac valvular lesion, when compensation is complete, or even renal disease confined to one kidney, need not, with care, involve the patient in greatly enhanced risk under anæsthesia. The danger to life when anæsthetics are given to patients suffering from angina pectoris with cyanosis is considerable, but not necessarily fatal.

Operations upon the Liver.—Unless glycosuria is present to a marked degree, the prognosis of ether anæsthesia is good, that of chloroform less so.

Diabetes.—The prognosis is bad, and the same is true when degenerative changes in the viscera are present.

Renal Conditions.—When the kidneys are adequate in function, the prognosis is good even if some albuminuria exists. As both chloroform and ether act upon the renal parenchyma, the employment of nitrous oxide and oxygen when feasible gives a better prognosis. The danger of the supervention of anuria is probably more an operative than an anæsthetic risk, and in estimating the prognosis this fact must be remembered.

Cardiac Conditions.—Morbus cordis, provided marked fatty change or uncompensated dilatation is not present, does not prejudice the prognosis of the anæsthetization.

Tachycardia and Tendency to Ventricular Fibrillation.—The prognosis is bad, but in this as in all heart conditions the basis of judging the prognosis is the height of blood-pressure and ability of the heart to maintain a sufficient blood-supply to the central nervous system.

Chest Conditions.—The prognosis is considered elsewhere, but it may be added that it is usually fair, provided care and appropriate agents and methods are adopted.

Septic Conditions.—It has been said that the pathological lesions seen after septic fever and after chloroform toxæmia are closely akin. This fact induces the anæsthetist

to employ ether in acute septic cases, either by inhalation, insufflation, intravenous infusion, or colonic-absorption methods. Probably septic states of the thoracic walls and contained viscera alone furnish exceptions to this contention. Spinal anæsthesia gives a very dangerous prognosis when marked septicæmia is present.

5. The Nature and Duration of the Operation and Intercurrent Conditions associated therewith.

Shock—Blood-pressure—Body Temperature.—It is impossible in this place to go into any lengthy discussion of surgical shock. From whatever cause it arises, we know that trauma in certain regions and involving certain structures appears to bring about conditions which are commonly grouped under the term 'shock', often associated with surgical procedures which in themselves do not seem serious and do not involve any great 'insult to tissue'. Such operations are those which involve the opening of the large somatic or cranial cavities—laparotomies, cœliotomies, opening of the thorax, exploratory operations on the brain and spinal cord. Further, when viscera, and especially certain serous membranes, are dragged upon and dislocated, such shock eventuates. In the case of serous membranes, Professor Yandell Henderson contends that the loss of carbon dioxide produces acapnia, a determining cause of heart failure. Undoubtedly the opening of such cavities leads to changes in the hæmodynamics of the body which may gravely prejudice the carrying on of the normal circulation. This is indicated, for example, by the rapid recovery of the patient when the abdominal walls are closed. We know that shock may be regarded as loss of body heat and fall of blood-pressure, and hence it becomes necessary that the anæsthetic, and method of using it, should be so safeguarded as to prevent an additional declension of either blood-pressure or body temperature. Since elimination of the anæsthetic, if from the lungs and kidneys, predicates abstraction of heat, it follows that the less anæsthetic there is employed the less will be the drain on the body heat.

A fall of blood-pressure is usually dangerous ; but if the initial blood-pressure is high, or if it is desired to prevent any engorgement of the vessels, as in cranial and spinal surgery, chloroform is adopted to facilitate the surgeon's work by lowering the blood-pressure. The addition of oxygen removes the danger of the lessened activity of the respiratory centre. Hæmorrhage antecedent to, or involved in, an operation is best met by introducing saline *pari passu* with the anæsthetic ; hence we adopt ether infusion, colonic etherization with tissue infusion, or some kindred method.

Prolonged operations are often necessary, and may prevent the use of spinal methods and their dangers as regards anæsthetics are—either excessive fall of blood-pressure leading to profound collapse, or undue stimulation followed by even greater collapse after the anæsthetic has ceased to be used ; while an after-danger exists owing to the cooling and shock engendered by the elimination of the large amount of the anæsthetic which has entered and become segregated in the tissues. The first danger is that of chloroform, the second is that of ether. The two conditions being compared, we find that the chloroform collapse is more rapidly and more readily surmounted than is its counterpart due to ether. In prolonged anæsthesia, such dangers can be avoided by careful moderation of the dosage. As time goes on, especially if traumatic shock and hæmorrhage occur, extraordinarily little anæsthetic is needed, and this minimum should never be exceeded.

The 'mixed method' of using scopolamine-morphine and atropine before the general anæsthetic, is most valuable in such cases, as it allows the anæsthetist not only to lessen the dose required for induction, but practically to maintain anæsthesia without inhalation. If this is overlooked, and the anæsthetist employs a large quantity of the anæsthetic, the patient is subject to grave risks. Overdosage causes extreme shock at the time of the operation, and collapse after its completion.

PROGNOSIS OF ANÆSTHESIA IN MILITARY SURGERY.—The two conditions requiring explicit consideration are : Shock ; Nervous-system dyscrasia—the psychological factor.

Shock may arise from trauma, 'insult to tissue', exposure, shell-burst, shell-blast concussion, nervous perturbation occurring in active or concealed neuropaths. The active factors which prejudice the prognosis if an anæsthetic is necessary are fall of blood-pressure, which may accrue from hæmorrhage due to wounds, and perturbation affecting the nervous system—psychic shock. The dominant feature is the time interval elapsing

between the moment when the damage was done and that at which surgical interference under anæsthesia is called for. Thus, the prognosis of anæsthesia in a collecting or clearing station is worse than that in a base hospital. Even when this last is in the home country, removed by many miles from the fighting line, and the anæsthetic is not given for a considerable time after the man is evacuated, the prognosis is worse than is the case with civilian patients. The condition of men reaching the casualty clearing station is commonly one which renders local analgesia and even spinal analgesia impossible, because in the first case the skin near the traumatized area is uncleanable, and secondly the blood-pressure is so low that spinal injection readily causes cerebral anæmia, with the worst possible prognosis. For this last reason giving chloroform is highly dangerous, as the prognosis, always grave, is within a few hours of the traumatization absolutely hopeless. Experience has shown that within about forty hours of the injury any depressant system of giving an anæsthetic is a source of great danger. With light narcosis, such as can be obtained with nitrous oxide and oxygen or warmed ether vapour, there is a fair prognosis, which improves as the interval of time between the administration and the injury increases. Alkaloids given before the anæsthetic assist in nerve-shock cases, and probably improve the prognosis, but no adequate direct evidence of this is available. The prognosis is satisfactory when the percentage of hæmoglobin is 100 or above, and in such cases intrathecal injection is permissible. If the blood-pressure has recovered most of its fall, chloroform may be used in such cases as when a wound of the abdomen is complicated by the injury having extended into the thorax. The prognosis of ether given by the endotracheal route is, in suitable cases, quite favourable, although it must be remembered that by this method the preliminary anæsthetization has to be deep to facilitate passage of the tracheal catheter, and the essence of safety in these patients is a light narcosis.

*The psychic factor*⁷ in traumatized patients is accentuated; fear depresses the blood-pressure, lowers resistive power, and perverts the 'will to recover'. It increases the gravity of the prognosis, and calls for urgent treatment either before or at the time of the giving of the anæsthetic.

Acidosis, a loose term meaning lessening of the alkali reserve or interference with the hydrogen-ion concentration, is a function of shock. Its occurrence in the civilian population, especially in children, has been noted above. In the present connection, however, it becomes a matter gravely affecting the prognosis. This condition arises from trauma, from chloroform and morphine, also from ether when that anæsthetic is given in excess. It is due to lessening of the conveyance of oxygen to the tissues, the result of fall of blood-pressure, or to lessened excitability of the respiratory centre causing a diminution of the pulmonary ventilation and hence again oxygen starvation. When acidosis is promoted and its effect added to that due to anæmia, as after a severe hæmorrhage, the prognosis of giving any anæsthetic is rendered more grave than under normal conditions. Certainly a careless or ill-chosen method may lead to dire catastrophe in the presence of acidosis.

Severe or Persistent Vomiting.—It is often necessary to subject a patient to an operation to relieve a condition which itself causes or has caused severe and persistent vomiting. Further, it is often necessary to perform an operation upon viscera, interference with which commonly brings about serious after-sickness. Vomiting, at all times troublesome, may actually determine death through exhaustion, since sleep and immobilization are necessary in order that traumatized tissues may heal. Therefore, in selecting the anæsthetic and method, we should take into consideration the likelihood of after-vomiting, and adopt measures to minimize the dangers arising from it. Patients vary within wide limits in their liability to vomiting.

The types of vomiting may be roughly grouped as follows:—

a. Catarrhal. This arises from irritation of the gastric mucous membrane. It is commonly due to swallowing mucus and saliva saturated with inhaled anæsthetic. Children, delicate women, 'bad sailors', the obese, and dyspeptics are most prone to this trouble. Unless the patient is unduly feeble, the prognosis is favourable, as the condition soon passes off.

b. Head vomiting. This arises from circulatory conditions, when not due to operative procedure on the brain, and can be obviated by avoidance of the lowered-head position. Unless there is obvious necessity for adopting the dorsal decubitus, a half-sitting posture

lessens after-sickness. This condition is especially liable to occur after spinal analgesia, and is very distressing, but it is not in our experience dangerous.

c. Visceral reflex vomiting. Operations, with or without general anæsthesia, upon the appendix, kidneys, rectum, or uterus, are peculiarly liable to produce serious vomiting; especially is this so in regard to the kidneys.

Probably both (*b*) and (*c*) fall into the category of toxæmia in many cases, and are closely allied to the so-called delayed chloroform poisoning. As with all patients who are the subjects of toxæmia, the prognosis is favourable or the converse according as two factors are recognized and dealt with: traumatism by handling and dragging upon viscera, and excess in the quantity of the anæsthetic given. A careful study of the conditions influencing sickness and general 'upset' after anæsthetics, made by the present writer, brought out very clearly the following fact. Whenever undue venosity of the blood was present, vomiting and severe after-collapse were developed. This condition may exist *ab initio*, as in the case of chronic bronchitics, when bronchitis, emphysema, and a dilated feeble heart are dominating the organism; in toxæmias, such as cholæmia, uræmia, septicæmia; or it may arise through exhaustion of the central nerve-controls through collapse following excessive stimulation, or through the employment of unnecessarily large quantities of the anæsthetic or too concentrated a vapour. The prognosis is worse in the case of ether than of chloroform, since large quantities of the former are given during the operation, and it is only after its completion that the collapse is observed.

Speaking generally, the prognosis as regards vomiting after general anæsthesia is favourable. Avoidance of 'insult to tissue', maintenance of body temperature, minimizing the amount of the anæsthetic, and avoiding the swallowing of mucus by giving atropine or chlorbutyl before the inhalation, with a correct placing of the head—lateral posture during operation, half-sitting posture later—will prevent serious sickness. The dangers in severe cases arise from the stomach rejecting all nourishment, and from absence of sleep. Here rectal or intramuscular injections of saline and dextrose, and the use of morphine in suitable cases, will be efficacious. Morphine, however, when given after chloroform will sometimes cause sickness, and in a curious way. The patient recovers from the anæsthetic, without nausea or sickness, and seems extremely well for twelve or twenty-four hours, when severe vomiting comes on and is at times very troublesome.

Vomiting after spinal analgesia is not infrequently severe and prolonged, especially if much encephalalgia exists. Although it is extremely severe in a few cases, the condition is transitory and amenable to treatment.

Stercoraceous Vomiting.—A much more dangerous condition may arise in cases of intestinal obstruction. The contents of the stomach and intestines are regurgitated, rather than vomited by muscular effort, and usually the flow commences as soon as the muscular tonus of the cardiac and pyloric orifices becomes lessened by the anæsthetic. It occurs both when general anæsthesia and spinal analgesia are employed. Unless it is possible to prevent aspiration of the material into the air-passages, the prognosis is most unfavourable. Even initial lavage is not a complete safeguard, although it should be used when practicable. As the back-pressure remains constant, when the stomach is emptied the intestinal contents still flow into it, so that the best method is to maintain a constant irrigation of the stomach. The shoulders and head of the patient should be kept high, and the head turned to the side, during the operation. The laryngeal reflex should be kept active. In very serious cases, intubation of the larynx with forced respiration, as obtains in endotracheal insufflation, or the method of a preliminary tracheotomy suggested by the present writer,⁸ may be employed. This lessens the likelihood of fluid ascending from the stomach. The patient should not be moved from the operation table until consciousness has returned.

6. Post-operative Effects.—It is unnecessary to dwell upon the immediate, and usually slight, after-effects of anæsthesia or analgesia. The more serious ones, that is, those threatening life, which occur within forty-eight hours or so after the operation, are respiratory, circulatory, nervous, metabolic, and renal. These have all been dealt with in the preceding sections, but may be summarized in this place.

In persons previously affected by bronchitis, inhalation of unwarmed vapour of ether or chloroform may determine a recrudescence of the disease. It is most common with

the former, partly because the vapour is more irritating, and partly because it lowers the body temperature from 0.5° to 3° F. during a prolonged inhalation. Bronchitis following chloroform is, as a rule, more severe, and associated with greater tissue destruction. Prolonged administration of nitrous oxide and oxygen in major surgery, unless the gases are warmed, may cause bronchial trouble, but it is an infrequent complication. It has been shown that when much bronchorrhœa is caused, the buccal, mucous, and bronchial secretions are aspirated and enter the smaller bronchi, setting up irritation. Tight bandaging, by impeding basal movements, prevents these fluids being expelled, and a pneumonic inflammation is initiated, since pneumococci are usually present in the mouth. As is stated above, many cases of so-called 'ether pneumonia' are really instances of massive pulmonary collapse, due to trauma affecting the diaphragm. Pneumonia of a septic type is liable to follow profound narcosis when operations upon the tongue, jaws, or upper air-passages have been performed, and is due to aspiration of blood, particles of growth, pus, or contaminated saliva and mucus. Such complications will usually reveal themselves within a week of inhalation. In this connection, the observations of Mikulicz published in a report issued in 1898 may be recalled. Having noticed the frequency of post-operative pneumonia after the use of ether, he replaced that anæsthetic in his clinic by chloroform. However, he soon found that the incidence of pneumonia was rendered greater by the change. Mikulicz then replaced chloroform by local and regional analgesia. To his surprise he found that post-operative pneumonia became more frequent still. Thus, out of 114 laparotomies, he lost 27 patients from lung complications. It follows that the prognosis in severe cases is more favourable when ether is used. That the lung complications attributed to anæsthetics are in fact due to infection from the abdomen, possibly through the lymphatics, appears to be more than probable.

Prophylaxis.—Before the operation, the teeth, mouth, and nasal passages should be assiduously cleansed, and unhealthy gums painted with an iodine preparation. If the breath is foul and the stomach unhealthy, lavage and careful asepticizing of the alimentary tract with salol or other means may be pursued. Atropine, given hypodermically, will lessen or prevent bronchorrhœa and salivation. The anæsthetic vapour should be warmed and moistened, and given so that the laryngeal reflex is active subsequently to full anæsthesia (third degree of narcosis) having been obtained by the induction. After the operation, the patient's body temperature must be maintained, and he must be protected from draughts as he is conveyed back to bed.

Hydrothorax and œdema affecting the bases may follow the exhibition of ether by inhalation if the kidneys are diseased and albuminuria exists. It may be associated with acute œdema of the tongue and larynx, and is usually fatal. If an undue quantity of saline is introduced by the method of ether infusion, pulmonary œdema is a serious danger; and hence strict limitation of the amount must be practised, especially if renal inadequacy exists.

Persons suffering from angioneurotic œdema are in serious danger lest the air-passages should suddenly become involved. I have met with one such case, and gave chloroform while tracheotomy was performed. Both local analgesia and ether are contra-indicated for these cases.

All anæsthetics, when inhaled in great quantity, especially if the oxygen content of the blood is not kept at about its normal during the administration, may cause tissue cooling, catarrh, irritation, and necrobiosis after the operation. The law is certainly true that the after-effects of an anæsthetic are, in severity and frequency, a function of the amount taken. If the vapour as it enters is warmed, some of its deleterious effects are removed.

Post-operative headache, back-ache, vomiting, oculomotor paralysis, and paralysis of the bladder and rectum, may follow spinal analgesia. We do not know for certain whether these arise through irritation of the analgesic or through alteration in the amount of the cerebrospinal fluid. Their occurrence is rare, but at times these sequelæ are alarming. Some surgeons regard them as evidence of errors of technique; but even so it is not possible to avoid them entirely, nor should we minimize their gravity when they arise. The possibility of acute mania or delusional mania consecutive to operations undertaken under local analgesia must be remembered. Such cases are rare, and the ultimate prognosis is favourable, though the condition causes great distress to the patient's friends.

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Dudley W. Buxton.

ANEURYSM, ABDOMINAL.—It is needful to remember that aneurysm of the abdominal aorta and its branches is an obscure disease, hard to detect in early stages; so that when the physician meets with a case in which there is no doubt as to the presence of an abdominal aneurysm, the sac is already large. Unhappily, the newer method of diagnosis by skiagraphy does not give as much help in the discovery of aneurysms below the diaphragm as it does in those situated within the chest. The stealthiness of the early stages of the disease is prejudicial to the patient's chance of recovery; a sac that can be felt is not likely to be 'cured'.

General Outlook.—I do not know of any proved example of complete and final cure of an abdominal aneurysm large enough to be diagnosed as such. Of course there are examples of what appeared to be a pulsatile swelling connected with the abdominal aorta failing to kill the patient; but these are usually cases of atheroma, and not of real aneurysm. Again, it is not an unusual experience to encounter healed abdominal aneurysms in the course of a post-mortem examination; but these are small, as a rule, falling far short of the size which must be attained if the sac is to be detected clinically. Moreover, abdominal aneurysms are not seldom multiple; in the patient who dies from rupture of one sac, another may be found completely obliterated by lamellæ of clot. True 'cure' of abdominal aneurysm diagnosed during life is therefore almost, if not quite, unknown.

In spite of this, patients may live for a considerable time after the onset of symptoms; in one of Nunneley's series, collected from the St. George's Hospital records, the duration of the case extended over nine years; while one of the Guy's Hospital patients, whose cases were tabulated by J. H. Bryant, lasted twelve years. These are, however, exceptions to the general rule; and the average expectation of life from the onset of symptoms, judging from the 86 cases included in these two series, is not more than fifteen months. The shortness of this period, as compared with that of thoracic aneurysm, is no doubt largely due to the greater difficulty of diagnosis; it cannot be ascribed to any added element of danger in the abdominal variety, for there is not the same risk of injury to vital structures that there is in aneurysm within the chest. Aneurysm of the abdominal aorta is usually limited to the retroperitoneal tissues, and it is into these tissues, in the great majority of instances, that the fatal rupture which terminates most cases occurs. The course of abdominal aneurysm is short because its earlier stages are not productive of symptoms.

Sudden Death.—In almost two-thirds of Nunneley's cases, in all of which the diagnosis was verified by post-mortem examination, the end came suddenly. In nearly all of these it was due to rupture, usually into the retroperitoneal tissues, rarely into the peritoneal cavity. It is this predisposition to rupture that makes an abrupt termination rather more frequent here than in aneurysm of the thoracic aorta; for, curious as it may seem when we reflect upon the varied opportunities presented to the thoracic aneurysm of rupture into neighbouring hollow viscera, it is the abdominal aneurysm, limited as it is by the parietal peritoneum lying in front of it, that bursts the more readily. In many instances the end is dramatically sudden, no warning of its approach being given until the patient drops dead. In others, a period of collapse sets in abruptly, with or without pain, a few hours before death. It is therefore essential to remember that when a patient with abdominal aneurysm faints away, it is likely that his hours will be few, particularly if severe pain accompany the onset of the faint. It is the more necessary to bear in mind this liability to concealed hæmorrhage, because it is so rare to find bleeding from an abdominal aneurysm declaring itself in the form of hæmatemesis, or melæna, or other external hæmorrhage.

Features of Prognostic Significance.—Everything that predisposes to activity on the part of the patient is prejudicial to recovery or prolongation of life. This factor counts for less, however, than in thoracic aneurysm, probably because the pain of abdominal

aneurysm is so crippling as to reduce nearly every one of its victims to a state of complete invalidism. For this reason, neither the age nor the occupation of the patient seems to have much bearing on his expectation of life, if we may judge from the records of cases. Sex, again, is of little importance, or at least it is difficult to assess any importance which may attach to it, for abdominal aneurysm is a rare disease in women.

Apart from such evidences of rupture as have already been mentioned, there is no help to be gained from the nature of the symptoms and physical signs in arriving at an accurate prognosis. It is true that, in a very few cases, surgical treatment has achieved satisfactory results; but the number of these is so small that it is impossible to generalize as to the features which promise success along these lines further than to say that extirpation is only possible when it is a branch of the aorta, and not the aorta itself, that is implicated. Such aneurysms, e.g., of the renal or hepatic arteries, are diagnosed with the greatest difficulty, and are oftenest found by accident or through exploratory laparotomy, so that there are no indications to enable the clinician to forecast a successful result.

Influence of Treatment on Prognosis.—The question that we should like to be able to answer is, Does any more radical method of treatment yield better results than the usual plan of rest in bed, with restricted diet, and drugs?

Proximal ligature of the abdominal aorta has been practised, both for aneurysm of the aorta and of its branches, in each case with immediately fatal results. The hepatic artery has once been successfully tied on the proximal side of an aneurysmal sac; but this aneurysm is extremely rare and seldom diagnosed. Moreover, in three other cases this operation was fatal. Aneurysm of the iliac artery within the abdomen and pelvis has been attacked by proximal ligature in 33 instances where the results have been recorded; recovery ensued in 9, the operation killing the remainder.

Extirpation is clearly impossible in nearly every kind of intra-abdominal aneurysm. It has, however, been successfully carried out in the treatment of aneurysm of the renal artery, the kidney being excised together with the sac.

Acupuncture, the method introduced by Macewen, cannot, as a rule, be safely undertaken except after incision of the belly wall. It is true that in Macewen's case this precaution was not taken, and the result was nevertheless satisfactory, the patient being alive and at work two and a half years later; in other cases, however, death has followed immediately after needling.

Introduction of wire into the sac, Moore's method, has been practised 10 times for abdominal aneurysm, death following more or less immediately in all but 2 instances. Corriadi's modification consists in the passage of a *galvanic current* through the wire introduced into the sac. This procedure has been put to the test in thirteen instances of abdominal aneurysm. The best result was in one of Finney's cases, the patient dying, three and a half years after operation, from rupture of the sac. In one other case the patient did well, dying eight months later of dysentery. The fate of a third patient is unknown, but cure was improbable. In the other cases, death followed within a few days.

It appears, therefore, that all surgical methods hitherto devised introduce an unjustifiable risk without offering any certain advantages to counterbalance it. One or two other plans of a somewhat less dangerous nature have to be considered.

Prolonged proximal compression through the abdominal wall, the method introduced by Murray, of Newcastle, and successfully applied by him to one patient who was alive six years later, has its limitations, and also involves certain risks. In the first place, there are but few cases of abdominal aneurysm in which the aorta can be compressed on the proximal side of the sac, which generally lies too near to the costal border to leave room for compression. In the second place, the pressure which is necessary, if it is to be effective, is such that it introduces a risk of injury to the bowel and other abdominal viscera, and fatal results have already been produced in this way. A preliminary laparotomy might remove this risk, but it introduces fresh disadvantages, so that this method cannot be said to promise better results for most patients with abdominal aneurysm.

Gelatin injection. There is, lastly, this method of Lancereaux. Though good results have followed in a few instances, no improvement has been recorded in the majority of

published cases. There is some risk of tetanus following the injection, though this has been circumvented by more careful sterilization of the gelatin. It is to be feared that this method does not improve the patient's prospect of cure.

It seems, therefore, that we must be content, for the present at any rate, with the ordinary medical treatment, along the lines introduced by Tufnell—absolute rest, reduction of diet and particularly of fluids, and administration of potassium iodide in full doses. This does not promise any great likelihood of cure, but it is at least free from risk; and since the patient is already invalided by pain, it does not impose any great restriction upon the activities which he would otherwise be free to pursue. *Carey F. Coombs.*

ANEURYSM, INTRATHORACIC.—Aneurysm, and fusiform diffuse dilatation of the aorta, must be considered apart, since the factors influencing prognosis are totally different in the two affections. This article, therefore, is devoted to a summary of the prognostic factors of sacculated aneurysm within the thorax.

The outlook in a patient afflicted with this disease depends on the balancing of two factors: the rate of growth of the aneurysm, and the rate of coagulation within the sac. Increase in the size of any aneurysm threatens to end the patient's life by hæmorrhage; to this, in the case of aneurysm within the chest, are added the various disabilities and dangers involved in pressure on vital or sensitive organs and tissues.

General Outlook.—Does *complete recovery* ever occur? In quite a number of autopsies, 'healed' aneurysms of the thoracic aorta and its branches have been found, but these were not detected during life. A few cases have been recorded in which an aneurysm, unmistakably present and even projecting through the thoracic wall, has become solid and remained so for periods of over ten years. The longest duration of which I can find any record was in a case quoted by Osler, in which the patient lived over twenty years after the condition was first diagnosed. So favourable a result as this is, however, highly improbable, even in these days of early diagnosis by radiography.

As to the *average duration of life* from the onset of symptoms, de Havilland Hall's figures are of value, since they relate to patients whose position in life enabled them to take every precaution. In 27 cases carefully followed up, the average duration of life amounted to about three years. It is more than probable that this period, brief as it is, is too long, if patients be included who are obliged to work.

In estimating the expectation of life that can be held out to any given patient, therefore, it is fair to take this as a basis: that though he may live for ten or fifteen years from the moment of discovery, it is not likely that he will last for more than three years.

Sudden Death.—Thoracic aneurysm is one of the notorious causes of sudden death. To the dangers never absent from a heart whose coronary arteries are diseased—as they are in a majority of cases of aneurysm,—are added those of rupture, with rapidly fatal hæmorrhage; and, in a few instances, those of aortic insufficiency.

In de Havilland Hall's experience in private practice, about one-third of his patients died suddenly.

This sudden termination may be due to cardiac failure or to rupture. The omens pointing to the former possibility are not different from those of chronic cardiac disease generally; paroxysmal cardiac pain, dyspnœa on exertion, the alternating pulse, and physical signs of aortic regurgitation, all enhance the risk of an abrupt failure of the contractile power of the heart. In de Havilland Hall's Westminster Hospital statistics, over 40 per cent of the deaths were due to cardiac failure. Aneurysms pointing externally rarely burst suddenly; indeed, leakage of blood into the subcutaneous tissues may continue for quite a long while in such cases without foreshadowing rupture, and the patient may die eventually of exhaustion or some such cause. Aneurysms of the intrapericardial aorta are particularly liable to burst into the pericardial sac; this is immediately fatal, but in most cases the diagnosis has not been made. Fatal hæmorrhage occurs more frequently in patients who present evidences of pressure on the trachea, bronchi, or œsophagus, than in those who do not show these signs. The rupture may also pour its blood into the mediastinal tissues; this also is more likely to happen if the sac arise from the transverse or descending part of the arch. Curiously enough, patients in whom the aneurysm bursts into a great vessel—superior vena cava or pulmonary artery—often

survive the immediate shock of the catastrophe and live for weeks or months. A common direction of rupture is into the left pleural sac ; this is particularly apt to occur in aneurysm of the descending aorta, and kills quickly.

Features of Prognostic Significance.—The *age* of the patient has a little bearing on the outlook ; the older the patient the better the prognosis. “Healed aneurysm is rarely seen in a man under forty” (Osler). This is partly due to the quieter life of elderly men, partly, perhaps, to the fact that the younger the man in whom an aneurysm has appeared, the more likely is it to be due to active syphilis of the aorta. And the more active the syphilitic process, the sooner will the aneurysm burst.

The *sex* is of some importance ; women carry aneurysms without final misadventure longer than men, presumably because they are subjected to less physical strain.

The *occupation and social position* of the patient is a consideration which influences the prognosis along the same lines ; the man who can take things quietly, and rest as much and as long as he needs, stands a far better chance than the man who must work or starve. Of course, there are extraordinary exceptions ; men with large aneurysms have been known to work at laborious occupations for years, but the great majority are not so fortunate.

Most thoracic aneurysms are syphilitic in origin, and result directly from spirochætal infection of the aortic wall. Unhappily, it is not always possible to detect this morbid process in the pre-aneurysmal stage, and once the aneurysmal sac has reached such dimensions that it produces symptoms, the aortic wall is injured beyond repair ; yet *early diagnosis*, such as is now possible by means of radiography, does undoubtedly improve the patient's chance. This comes about in two ways : vigorous antisiphilitic treatment, if instituted as soon as the diagnosis is made, may prevent extension of the aortic disease ; and the patient also comes under restraining influences in time to obviate, or at any rate to postpone, disaster.

The *site of the aneurysm* has a most important bearing on the patient's hope of survival. Something has already been said about this in considering the risks of sudden death. Broadly speaking, it is the aneurysm that springs from the ascending extrapericardial portion of the aorta that lasts longest ; its tendency is to extend to the right into the lung, or forward by erosion of the chest wall, and in spreading in either of these directions it encounters structures of relatively little importance ; the pain that is caused by injury of intercostal nerves wears the patient's strength down ; but when the aneurysm bulges forward as a definite tumour consisting mainly of solidly packed clot, it is astonishing how long life may last. Even when the swelling has attained a very large size, the patient may carry it for months, or even years. The writer recollects one such case, in which the aneurysmal sac presented over the greater part of the right front, below the right costal border, and also below the inferior angle of the right scapula ; and yet the patient survived in hospital for several months and died eventually of exhaustion, though the sac had leaked through the front of the chest wall for weeks. One of the worst things that can happen to an aneurysm arising from this part of the arch is rupture into the superior vena cava ; this often leads to death in a few days, though, in one case seen by the writer, the patient survived for several months after the rupture occurred. Rupture into the pulmonary artery is less immediately fatal, especially when the communication is established gradually, as it is in some cases.

The most quickly fatal form of aortic aneurysm is that which arises from the intraperitoneal portion ; this type shares with coronary aneurysm a peculiar predilection for rupture into the pericardial sac, a calamity which is fatal at once, or in a very short time. Possibly earlier diagnosis might help to avert this ; but even with the *x* rays it is not easy to be sure of the presence of this type of aneurysm, and while it is still comparatively small, the fatal rupture is apt to occur.

Aneurysms springing from the transverse aorta are especially dangerous on account of their proximity to vital organs, and to hollow viscera into which rupture may occur. Approximately one-third burst, especially into the trachea, left bronchus, or œsophagus, or into the left pleural sac. The danger of rupture may be apprehended, therefore, when the physical signs point to the existence of pressure in these directions ; and particularly if the sac appears to be dribbling into one or other of the hollow tubes. Apart from the danger of rupture, there is that of interference with important functions ; asphyxia

from pressure on the trachea may end the patient's life; the œsophagus may be compressed and swallowing hindered; or—more probable still—pressure on the left bronchus may lead to the retention of secretions, with bronchopneumonia or some other form of pulmonary infection. Any evidence pointing to such occurrences is of the gravest import, for pulmonary infections of this type do not take long to kill.

Aneurysms of the descending portion of the arch and the descending intrathoracic aorta are very apt to rupture, especially into the left pleural cavity; in Dr. Oswald Browne's statistics, collected from St. Bartholomew's Hospital, this was the end of more than one-third of the cases of descending thoracic aneurysm. Next after this comes rupture into the œsophagus or left bronchus. The sac that bursts in these directions is often quite small; the writer recollects making an autopsy in a case of fatal hæmorrhage into the œsophagus from an aneurysm no larger than a walnut. When the difficulties of diagnosis, and therefore the improbability of early treatment, are taken into account, it is easy to see why the prognosis is so gloomy in cases of descending thoracic aneurysm.

Dissecting thoracic aneurysm, curiously enough, often spares its victim for years after the etiological rupture has taken place. A case of survival for thirty years is on record, and there are others nearly as long.

Aneurysms arising from the great vessels, in the intrathoracic portion of their course, have yet to be considered. It might appear that the prognosis would be more favourable in such cases, since they seem to offer a possibility of surgical attack. As a matter of experience, however, the outlook is no better than in the case of aortic aneurysm. The sac so often arises close to, if not actually at, the point where the vessel leaves the aorta, and the aorta itself is so frequently the seat of advanced syphilitic disease, and even of a second aneurysm, that little more chance of successful treatment is offered than in the case of aortic aneurysm.

Lastly, there are one or two general considerations.

Multiplicity of Aneurysms.—The possibility of this must never be forgotten. Occasionally, the sac which is obvious may be undergoing solidification, while another undetected aneurysm, or a new pouch of the primary sac, may be spreading in a different direction. Before a favourable prognosis can be given, therefore, every effort must be made to exclude the presence of a second sac.

Situation of Hæmorrhage.—Speaking broadly, hæmorrhage to the surface, whether direct or through a hollow viscus, is less deadly than internal bleeding: it may stop itself by the fall in blood-pressure which it induces; whereas, in hæmorrhage into a closed space, there is not only loss of blood, but also disturbance of internal pressure, to be considered. Rupture into the pericardial sac, for example, is fatal, not because it deprives the patient of blood, but because it embarrasses the heart.

Evidence of Solidification.—The most favourable omens in any case of thoracic aneurysm are those which point to solidification by deposition of fibrin; they are limitation of pulsation, hardening and shrinkage of the sac, and increase in the density of the *x*-ray shadow. Unhappily, it is not possible to study these processes satisfactorily in many cases; only those which are pointing through the thoracic wall can be palpated; but when, in such cases, the tumour is becoming harder and throbs less, the outlook is relatively favourable. Even so, the possibility of spread in another direction must be kept in mind.

Influence of Treatment on Prognosis.—Is it possible to say that the outlook is improved by the adoption of any particular line of treatment? The results achieved by the various plans of treatment in use must be compared in order to answer this question.

First, there is what may be called the *ambulatory plan*. The patient is restrained from severe exertion, but he is allowed to walk about and do his business, provided it does not entail heavy labour; drugs, usually potassium iodide in full doses, being given meanwhile. Remarkably good results are achieved in some cases, particularly when the patient is a reasonable being, and able to regulate his life wisely; but over against these successes must be set a large number of failures, including a considerable percentage of sudden deaths from rupture. It is impossible to form a definitely calculated estimate of the expectation of life to be offered to the patient who chooses this plan, or is obliged to be content with it; but the writer, judging from out-patient experience, would, on an average, place it at something within two years.

Second, the *Tufnell plan* must be considered. This term includes absolute and prolonged rest, with restriction of diet, especially in the matter of fluids; convalescence is jealously guarded, and there is no eventual return to heavy bodily work. Here again it is very difficult to supply figures, for a large number of patients undergo treatment which is a compromise between, or combination of, this plan and the preceding one. De Havilland Hall's figures, relating to 27 cases, show that the average expectation of life in patients who have followed the Tufnell plan for as long as they could endure it, and have subsequently ordered their lives as peaceably as they might, is about three years from the onset of symptoms. Remarkable successes are sometimes achieved by this plan, provided the period of absolute rest be repeated from time to time as symptoms dictate; and, from a survey of the available facts, the writer is inclined to claim that a higher percentage of survivals over five years is to be found among patients undergoing this than among those following any other method.

Third, the *gelatin treatment*, introduced by Lancereaux, was rather discounted at first by the fact that it was followed by tetanus in a few cases. This, however, can be avoided; and the method has been fairly tried. Kingston Fowler's results, in 12 cases treated along these lines at the Middlesex Hospital, did not, in his opinion, show any superiority over those attained by other methods.

The use of modern antisyphilitic compounds of arsenic has not been proved to increase the expectation of life in aortic aneurysm. The causal process has already done so much damage by the time the stage of aneurysm is reached, that efforts to cure by arresting it are foredoomed to failure.

Lastly, *surgical methods* remain to be considered. Attempts at extirpation of an intrathoracic sac arising from the aorta have, without exception, been immediately fatal. According to Monod and Vanwerts, who examined records of 77 recent cases of innominate aneurysm treated by distal ligation of the common carotid with the subclavian or axillary artery, temporary improvement followed in 57 per cent, immediate death in 14 per cent, and the remainder were classed as failures.

Of late years American clinicians have given a thorough trial to wiring methods, i.e., treatment by the introduction of wire into the sac of the intrathoracic aneurysm, with or without the passage of a galvanic current through the wire. Even when due allowance is made for the desperate nature of the cases to which such a plan is likely to be restricted, the results cannot be regarded as encouraging. In Eshner's table of 38 cases, death followed, in exactly half, within a month of the operation; but 1 patient survived for twelve years. Of Hall's 22 cases, 1 lived for five years; and of Finney's 23 cases, 1 lived for three years. Regarded from the prognostic view, therefore, it does not seem that longer life can be promised to the patient who submits to this operation.

To sum up, the truth is that the outlook in any case of thoracic aneurysm is bad; the average expectation of life is not more than three years, and even this brief period is not likely to be attained if the sac be projecting backwards from the transverse or descending aorta. Life is more likely to be prolonged if the patient is able to submit himself to the ordeal of complete rest with restriction of diet, and if the diagnosis be made early.

Carey F. Coombs.

ANEURYSM OF PERIPHERAL ARTERIES.—Although spontaneous cure of a peripheral aneurysm has been known to occur, it must be very rare. In these days of surgery it is almost invariably the practice to operate instead of waiting to see what nature might do; but in the pre-antiseptic era various methods of natural cure, by extension of clot from the sac, 'plastic arteritis', pressure of the sac on the artery, etc., were described, and in a few cases an aneurysm has been known to slough away *en masse*.

Further, aneurysms are not always progressive, but may last for years without appearing to do any harm. In the end, however, the recorded cases all required treatment for severe symptoms. The writer has seen a carotid aneurysm in a woman who had had it for many years and suffered little or no inconvenience, and was therefore unwilling to have it operated on. They are more rapidly progressive in the young and vigorous than in feeble old persons with a reduced circulation.

The life of a patient with an aneurysm is, however, always in jeopardy. Sooner or later it is liable to rupture into the subcutaneous tissues or externally, causing rapid

death from loss of blood, or such grave disintegration of the cellular planes as may lead to the necessity for amputation. Occasionally suppuration may take place. The deadly nature of the disease is emphasized by the fact that even in the infancy of the surgical art, before anæsthetics or antiseptics had robbed it of its terrors, when nothing but the direst necessity led the surgeon to abandon the expectant method and perform a major operation, there were a number of well-established methods for the operative treatment of aneurysm. Apparently the condition used to be commoner than it is now. We must allow due weight to the experience of these early surgeons, that the policy of letting an aneurysm alone usually led to disaster; but what was the exact frequency of such disaster we have no figures to show, nor are we likely to have in the future.

Aneurysm following gunshot injury is somewhat more favourable. During the first few weeks, at any rate, some of the cases improve; thus an arteriovenous aneurysm may be converted into the much less serious aneurysmal varix.

Treatment by Compression has almost been given up, except where operation is quite impossible. It is painful and tedious (the average time in 26 cases was nineteen days). It only cures a minority of the cases; thus Barwell found that of 148 instances of popliteal aneurysm treated by compression between 1870 and 1880, 68 succeeded and 80 failed. It may reduce the prospects of success of the subsequent ligature by dilating up the collateral circulation.

Treatment by Operation.—We are greatly indebted to the excellent studies of the literature by Monod and Vanwerts for our knowledge of the end-results of the various methods of treatment of aneurysm. They have done their best to eliminate the usual fallacies of statistics collected from recorded cases instead of consecutive hospital series, but it is probable that successes and new methods figure a little too prominently even in their carefully-compiled tables. In a study of 410 recorded cases, they found that after proximal ligature about three-quarters were cured, 12 per cent failed, and 6·5 per cent suffered from gangrene. There was often persistent pain from adhesions of nerves to the sac. Of cases treated by extirpation, 90 per cent were cured, and 4 per cent developed gangrene. Of 105 cases treated by Matas' method of aneurysmorrhaphy, conserving the artery if possible, 85 were cured and 12 died. Their results may be set out in tabular form thus :—

ANEURYSMS OR OLD ARTERIAL HÆMATOMATA.

Method	Cases	Cured	Died	Gangrene	Failure
		per cent	per cent	per cent	per cent
Ligature - - -	138	74	7	6·5	12
Extirpation - - -	205	90	3	4	1·5
Antyllus - - -	41	80	17	2·5	0
Aneurysm. oblit.* - -	62	88	8	7·5	0
Op. conservativ.† - -	46	73	20	0	22

* Matas' obliterative aneurysmorrhaphy. † Matas' reconstructive methods.
(The percentages do not always total exactly 100, because they are expressed in round figures, and some of the gangrenous cases also died.)

The following tables are quoted by Tscherniachowski from various sources to illustrate the frequency of occurrence of gangrene after various older methods of operation :—

Method		Arm		Leg		Total	
		Cases	Gangrene	Cases	Gangrene	Cases	Gangrene
			per cent		per cent		per cent
Monod and Vanwerts	Ligature -	10	0	68	11·7	78	10·2
	Antyllus -	5	0	19	5·2	24	4·1
	Extirpation	32	0	145	6·2	177	5
Wolff	Ligature -	12	16·6	71	19·7	83	19·3
	Antyllus -	2	0	5	20	7	14·2
	Extirpation	11	0	44	18·1	55	14·5

After aneurysmorrhaphy, gangrene occurred in 3.3 per cent, and recurrence in 2.7 per cent, of 149 cases extracted from the literature by Gardner (1910).

We shall now take up the principal arteries in turn.

Popliteal Aneurysm.—Of 20 cases treated by the older methods in the London Hospital, ligature in Scarpa’s triangle gave the best results, but the literature quoted above shows that extirpation is better on the whole.

Monod and Vanwerts compare the older methods of treatment with the conservative operation of Matas, as shown in the following table (in some cases the result is not known, hence the tables appear not to balance) :—

Method	Cases	Cures	Deaths	Gangrene	Failure
Conservative operation -	38	32=88.8%	0	0	4=11.1%
Non-conservative operation	206	180=87.3%	5=2.4%	14=6.8%	6=3%

Gangrene has, however, been known to follow aneurysmorrhaphy. It will be seen that the proportion of cures is about the same ; the ligature and extirpation methods run more risk of gangrene, whereas the Matas operation is more likely to be followed by recurrence.

Femoral Aneurysm.—Here again the cures are about the same with the older and the newer methods, and one has to balance risks of recurrence against risk of gangrene.

Monod and Vanwerts have obtained the following statistics from the literature :—

Method	Cases	Cures	Deaths	Gangrene	Failure
Conservative operation -	34	31=91%	2=5.8%	0	1=3%
Non-conservative operation	166	149=90%	11=7.2%	7=4.3%	0

The authorities differ as to whether, if ligature is adopted, it is wiser to tie the common femoral or the external iliac, the former being more likely to cure the aneurysm, and the latter more likely to avoid gangrene. No doubt, when they are feasible, the best of the non-conservative operations would be the Antyllian or extirpation.

External Iliac Aneurysm.—This rare disease may be treated by ligature of the common iliac artery by the intraperitoneal route, by extirpation, or by aneurysmorrhaphy. Matas gives the results as follows, using only post-1880 evidence, but the data are not very clearly set forth :—

Method	Cases	Cured	Deaths	Gangrene	Failure
Ligature - - -	21	?	10	7	?
Extirpation - - -	5	4	0	1	0
Aneurysmorrhaphy -	7	4	3	1	1

Of the 7 patients treated by Matas’ method, one became gangrenous and died, another relapsed and ruptured, and a third died of pulmonary embolism. The others appear to have been cured.

Monod and Vanwerts report 9 cures and 10 deaths after various operations.

Gluteal Aneurysm.—There appear to be no reliable figures relating to the treatment of this condition which do not go far back into pre-antiseptic times, and are therefore valueless. Delbet reports 12 out of 14 cases cured by the operation of Antyllus. Bergmann teaches that cure can often be obtained by the injection of ferric chloride, and Vanwerts declares that ligature of the internal iliac gives excellent results.

Subclavian Aneurysm.—Monod and Vanwerts report :—

Method	Cases	Cured	Failure	Died
Proximal Ligature - - -	63	44	9	10
Extirpation - - -	11	10	0	1

For many years a curious fatality hung over the operation of tying the first part of the subclavian, and the first 19 cases all died, but the last 10 French cases have all recovered (up to 1911).

Axillary Aneurysm.—Using once more the statistics of Monod and Vanwerts :—

Method	Cases	Cures	Deaths	Gangrene	Failure
Conservative operation	6	4=66·6%	1=16%	1=16%	1=16%
Non-conservative operation - - -	63	51=81%	3= 4·7%	2= 3%	5= 8%

The non-conservative operations include ligature of the subclavian, extirpation, and the method of Antyllus, whereof extirpation, when possible, is the best.

Innominate Aneurysm.—It is very seldom possible to apply a proximal ligature, but a considerable number of cases have been treated by tying the carotid and subclavian arteries. In the older literature there was a heavy mortality from sepsis and hæmorrhage, and out of 120 cases only 7 cures resulted (Jacobsthal) ; but Vanwerts is able to quote 77 recent operations, whereof 14 per cent died, 57 per cent improved, and 19 per cent failed.

Carotid Aneurysm.—Monod and Vanwerts could only find one case of aneurysmorrhaphy, which was fatal. The results of the older methods may be set out thus :—

Method	Cases	Cures	Deaths	Failure
Ligature - - - -	16	13	0	3
Extirpation - - -	17	14	3	0
Incision - - - -	3	2	1	0
Aneurysmorrhaphy	1	0	1	0

Arteriovenous Aneurysm.—This is usually the result of a stab or bullet wound, and, as Makins has pointed out, it is wise to wait some months after the latter injury before operating. Mere proximal ligature may reduce it to an aneurysmal varix, but will not be curative ; the essential point is to separate the artery and the vein. Vanwerts has collected 15 cases of quadruple ligature of the artery and vein, each above and below ; 3 became gangrenous, and 9 were cured. Extirpation, practised in 117 cases, gave 95 per cent of cures, and 1·7 per cent gangrene. Nowadays arteriorrhaphy might well be tried.

Gangrene is of course more likely to follow operation on the common femoral or popliteal than on the vessels of the arm or the superficial femoral.

Aneurysmal Varix.—In the great majority of cases this does no harm, and a bandage is sufficient treatment. If it is necessary to do anything, the best results have followed ligature of the artery above and below ; simple proximal ligature is futile. Arteriorrhaphy would be worth a trial.

No figures are yet available, on a sufficient scale, to show the end-results of treatment of aneurysms following gunshot injury in the Great War, but in general terms it may be stated that in early cases operated on within a few weeks for urgent symptoms the outlook is worse, and in later cases better, than in spontaneous aneurysm. Apparently

aneurysmorrhaphy has very seldom been found suitable. Excision has been the method of choice.

REFERENCES.—*Keen's Surgery*, 1909, vol. v, article "Aneurysm"; Tscherniachowski, *Deut. Zeits. f. Chir.* 1913, June, 1; Monod and Vanwerts, *Rev. de Chir.* 1911, 663. *A. Rendle Short.*

ANGINA PECTORIS.—When we say of a patient that he is suffering from angina pectoris, we mean that he is troubled by bad attacks of cardiac pain, which constitute a prominent feature of his case. An account of the prognosis in angina becomes, therefore, an account of the prognostic significance of a symptom, and not a summary of the menaces contained in a definite disease. Angina pectoris will here be spoken of as a symptom of organic disease of the heart; imitative attacks will be alluded to at the end.

True angina is always evidence of one thing—impaired contractility in the wall of the left ventricle. This is often (but not always) associated with interferences in the supply of blood to the myocardium, through the coronary arteries. Now inadequacy of contractile power in the ventricular myocardium is a serious matter, and any lesion that can produce it is a veritable shell in the engine-room. The first statement to be made, therefore, is that angina is always a grave symptom in any case of cardiac disease. Its appearance in a patient who has never shown any previous evidence of a lesion of the heart must always call for a minute investigation of the case from every point of view, to ascertain the precise nature of the injury that is causing it. On the other hand, when a patient who is known to carry a damaged heart has his first paroxysm of angina, the prognosis is made graver than before, simply because it shows that the vital part of his heart, the muscle of his left ventricle, is becoming unequal to the demands which are made on it. It must be added that the very occurrence of angina introduces into the case a risk of sudden death; this point will be examined in detail later. The average period elapsing between a first attack and the patient's death is not easy to ascertain.

General Outlook.—In order to determine the outlook in any given case of angina, four points must be examined: (1) *The nature of the cardiac lesion*; (2) *The circumstances provoking the attacks*; (3) *The nature of the attack itself*; and (4) *The condition of the heart after the attack is over*.

1. *The Cardiac Lesion.*—Angina pectoris occurs in connection with acute as well as with chronic disease of the heart, but far more frequently with the latter; probably because any acute disease which injures the myocardium severely enough to cause angina will quickly go to a fatal issue. From the prognostic point of view, a classification which divides the myocardial states responsible for the occurrence of angina into those which are primary and those which are secondary, is of more value than a division into acute and chronic lesions. The primary conditions are those in which the myocardium itself is diseased; the chief examples of these are cardiosclerosis, cardiac syphilis, alcoholic degeneration of the myocardium, and acute infection of the myocardium in such diseases as rheumatism and typhoid fever. The secondary causes of angina are those in which the myocardium is relatively free from disease, yet unequal to some abnormal circulatory strain thrown upon it, the chief examples of which are disease of the aortic valves and high arterial tension. Even this classification has only a limited value, for the two classes overlap at certain important points: for instance, cardiac syphilis and disease of the aortic valves frequently coincide; so also do cardiosclerosis and high blood-pressure. Nevertheless, the classification is of some service in the present connection if it emphasizes the fact that the outlook is graver in those cases where angina is directly connected with disease of the myocardial tissues than in those where a fairly healthy myocardium is confronted with a task too heavy for it.

In determining the nature and seriousness of the cardiac lesion responsible for anginal attacks, therefore, it is necessary to gain an idea of the state of the myocardium, the arteries, the arterial tension, and the valves of the heart. All signs pointing to gross disease of the myocardium make the prognosis graver; such signs are feebleness of the pulse and heart-sounds, embryocardia and gallop-rhythm, the alternating pulse, dyspnoeic attacks too readily provoked, œdema of the ankles. On the other hand, if the impulses be powerful and thrusting, and indicative of hypertrophy of the left ventricle, and signs of some extraneous cause such as aortic incompetence or high arterial tension be present,

the prognosis is better, and particularly where the extraneous cause is one that can be modified and reduced by treatment (high arterial tension), or is, at least, not progressive (post-rheumatic incompetence of the aortic valves in an adult). Of course, very high tension that does not yield in the least to treatment is a grave cause of angina, for it is likely to be progressive. Again, angina as a symptom of aortic insufficiency is of far more sinister import when associated with syphilitic disease of the aortic valves than in cases of post-rheumatic valvular disease; for in the former case there is sure to be progressive myocardial disease associated with the valvular lesion; whereas, in the latter (provided the patient be over twenty), the risk of direct myocardial injury is remote, and such myocarditis as may occur tends towards recovery and is not progressive. The aortic incompetence of general atheroma lies midway between the two; the myocardium is directly attacked through disease of its nutrient arteries, and it will become worse, but not rapidly so, as in the case of syphilis. Sometimes, of course, the prognostic import of the angina is overshadowed by that of other findings, as when signs of aortic aneurysm are discoverable.

A general rule applicable to all cases of angina, however, is: the worse the myocardium, the worse the prognosis. The marks of a bad myocardium are to be found partly in the patient's own statement, partly by physical examination, and partly by inference.

2. *The Circumstances Provoking Anginal Attacks.*—These circumstances are of various kinds; the chief are exertion, emotion, meals, and external cold. In a number of cases no provocation is discoverable, the attack coming on while the patient is at rest in bed. Two obvious generalizations spring into the mind at once, or rather, two aspects of the same generalization. The first is that the more readily the attacks are provoked, the worse the prognosis. There is much less menace in angina which comes on in the middle of a sprint to the station than in that which brings to an abrupt termination an attempt to walk up a barely perceptible incline, even though the former be the severer attack. The second is that if the provocative cause be a controllable one, the outlook is by so much the better. Obviously the man who only gets angina after overloading the stomach is in a better case than the one whose attacks are provoked by all sorts of causes, and by no apparent cause at all. In this sense, it is better to have one cause for the attacks than many; for example, the man who only gets attacks when he stoops to do his boots up can foresee his danger and circumvent it by taking care, while he who never knows what petty excitement or effort may throw him into peril cannot be so precisely forewarned, and thereby forearmed. In this connection, the patient's temperament is important; the headstrong man, who will not be advised, must expect evil consequences if he will not curtail his activities and live within the limitations of his myocardium. If he can and will avoid such circumstances as have been found to provoke attacks, the prognosis is better.

3. *The Nature of the Attack itself.*—Here it must be acknowledged that *a priori* reasoning is singularly apt to mislead. Patients have been known to live for years after a tremendous bout of prolonged agony of mind and body, while others sink rapidly after an attack which was so slight as to be misinterpreted at the time. Yet the longer experience one has, the more certainly does one expect serious consequences after long and severe attacks of cardiac pain. Such attacks, especially if accompanied by vomiting and collapse, are often proved by the subsequent course of the case to have marked the occurrence of a coronary thrombosis, usually a fatal blow to an already staggering heart. The prognosis is worse if the attack be accompanied by respiratory changes (grouped breathing or 'cardiac asthma'); so, also, if the pulse become slow and there are evidences of heart-block, or if the patient faint during the paroxysm. One point that gives some help is the effect of vasodilators; attacks that are readily relieved by the exhibition of nitrites are less portentous of evil than those that are refractory to treatment, presumably because the angiospastic factor, the one which is neutralized by nitrites, is less threatening than the myocardial, which is influenced only indirectly by this form of treatment.

4. *The State of the Heart after the Attack.*—This is of the greatest significance. Here, again, it is the condition of the myocardium that matters; has it been definitely and perceptibly worsened by the attack, or by the changes which provoke it? Two or three examples will serve to illustrate this point. A strong man of over seventy had for some time been getting shorter of breath, but there had been no pain till one day after walking

up a very gentle incline ; even then it was not very severe, and soon passed off under treatment. However, the heart-sounds were feebler after it than before, the patient was bluer and more breathless, and the feet began to swell ; in a few days he died rather suddenly in his arm-chair. In another case, a patient with aortic regurgitation of the atheromatous type, who had survived years of anginal attacks, one, at least, so severe and obstinate as to necessitate the use of chloroform, died within a few days of a comparatively slight seizure of pain, which was followed by the development of a pericardial rub with quickening of the pulse. A third patient, who had been troubled with severe angina for over a year, had a sudden attack in bed one day ; on the following day his cardiac dullness had perceptibly increased, and a pericardial rub was heard ; a day later he died suddenly in bed. In this last case the right ventricle was found ruptured at the autopsy. The probability is that in most, if not all, such attacks a large coronary branch has become obstructed by thrombosis. This is followed by grave alterations in the structure and function of the cardiac muscle, manifested to the clinical observer by certain signs : lasting acceleration and enfeeblement of the pulse, alternation of the pulse where this did not before exist, increase in the area of cardiac dullness, widening in the area of impulse with diminution of its force, softening of the heart's sounds, development of a cantering rhythm, and—most significant of all when it occurs—the appearance of pericardial friction. In a few cases the electrocardiogram has shown changes in the ventriculosystolic complex which prove the existence of wide injury to the myocardium. Death follows within a few days of such attacks in nearly all cases.

So much, then, for the general outlook in any patient with anginal attacks ; it all turns on the state of the myocardium before, during, and after the attack, and the degree of overstrain needed to bring out that inadequacy of which angina is a symptom.

There are, however, two other questions which we must be ready to answer : the likelihood of sudden death, and the probability of recurrences of that attack.

Sudden Death.—Patients who have had sharp bouts of angina do not ask about the risk of sudden death ; they have tasted its bitterness already, and know so much of the danger that they do not care to know more. The relatives, however, not seldom want to know “whether he is likely to go off in an attack” ; and this is not unreasonable, for the patient looks more than half dead if the paroxysm be at all severe. Further, writers of fiction and of medical text-books have insisted so much on the association between angina and sudden death that the two ideas have become inseparably linked in the public mind. Now, while it is perfectly true that in a few dramatic instances the heart stops during the paroxysm, it is equally noteworthy that a considerable majority of those who are subject to angina do not die during the attack. This having been explained to the friends, it is advisable to give a rather fuller explanation of the risks of sudden death implied in anginal attacks ; that although the onset of cardiac pain must not be regarded as necessarily threatening imminent death, yet the very occurrence of such attacks is a warning that the muscle of the heart is barely equal to its work ; that it may fail abruptly or acutely with or without forewarnings of pain ; and that death is apt to follow attacks of pain after an interval of days or hours. The actual imminence of sudden death, in any given case, depends entirely on the conditions found to underlie the patient's liability to angina ; those points to which attention has been directed as giving a key to the general prognosis in any given case will also assist in an estimation of the risk of sudden death.

Recurrence.—Another question that the patient may dare to ask for himself after the first attack bears on his liability to a return of the experience. Now he may be quite truly assured that it is possible that he may never have it again, particularly if that which provoked the first attack be some avoidable circumstance, such as going out insufficiently clad on a frosty day, over-eating, and the like. A surprisingly large number of persons have only one attack, or else a few attacks at long intervals ; while some go through a series, and come out into smooth water again. Such good fortune falls especially to those whose heart is in fair condition, but overtaxed by a high arterial tension, or by leaking aortic valves and a laborious occupation ; and only to such of these as are willing to go softly. Indeed, it is here that the whole philosophy of angina comes in. Pain is a warning, a protective phenomenon, which says to its victim, “Don't do that again” ; if the anginal patient will listen to this advice, he may escape further punishment.

Where, however, the heart is the seat of syphilis, or the arteries are profoundly degenerated, the friends must be warned of the likelihood of recurrences, and of all that we have seen implied in them. Moreover, it is well to bear in mind the fact emphasized by Mackenzie, that cessation of pain is not always a good prognostic sign; if accompanied, as it sometimes is, by the onset of mitral insufficiency, with anasarca and increasing dyspnoea, the patient may be regarded as having entered on the last stage of his journey, even though he may never again have any suspicion of angina.

Vasomotor Angina.—The very existence of such a syndrome has been denied. Yet there are cases of cardiac pain coming on in paroxysms, which may or may not begin with phenomena of angiospasm in the fingers, occurring as a rule in young adults with no signs of cardiac disease, and returning from time to time for periods of years. The outlook as to life is good in such cases, but liberation from the attacks cannot be promised. The nearer the patient approaches to the arteriosclerotic period of life, the greater is the necessity for caution and reserve in prognosis. Even if the attacks are indeed angiospastic to begin with, their repetition in arteries beginning to lose their elasticity cannot be regarded without anxiety.

Pseudo-angina.—A final word remains to be said about the shadowy group of cases designated 'pseudo-angina', 'toxic angina', and so on. Climacteric women are liable to attacks of pain which is more or less obviously cardiac; and over-smoking may bring on the same kind of trouble. Obviously, such attacks, which do not depend for their origin on organic disease of the heart, do not carry with them any menace to the patient's life; moreover, they will cease to occur when the cause has ceased to operate. The whole difficulty of prognosticating truthfully in such cases, then, lies in diagnosis of the cause or causes of the attacks. The task is to find out whether or no we are dealing with a sound myocardium; if the physical signs and other circumstances (the patient's age and his position, consumption of tobacco, nature of attacks, and so forth) point away from serious disease of the myocardium, then the prognosis is good.

Indeed, this is the whole secret of successful prognosis in cases manifesting angina pectoris. It is a symptom of myocardial inadequacy, and the prognosis varies directly with the state of the myocardium: *good heart muscle, good prognosis; bad heart muscle, bad prognosis.*

Carey F. Coombs.

ANKYLOSTOMIASIS.—By ankylostomiasis we mean the anæmia produced by a large number of ankylostomes in the bowel for a considerable period of time. In addition, about 80 per cent of healthy persons in many parts of India harbour a few worms without apparent harm, but are a source of infection. When from fifty to several hundred are present for months, they produce serious and sometimes fatal disease if not detected and efficiently treated in time. Darling regards 50 worms as a slight infection, 50 to 100 as a moderate one, and over 100 as a severe one. The numbers may, however, not rarely reach 500, while as many as 3000 have very occasionally been met with in the human bowel. Darling estimates that one per cent of hæmoglobin is lost on the average for each 11·7 worms in men, 10 in females, and 7·6 for boys of nine years of age, and he obtained an average rise of 9·2 per cent of hæmoglobin in treated cases, while in Colombia, where 98 per cent of the population were infected, the average hæmoglobin content was only 45·5 per cent, but was increased by about 20 per cent by anti-hookworm treatment. In Porto Rico, Ashford estimated that about 30 per cent of the total mortality was due directly or indirectly to this scourge, while the general health of a much larger proportion of the people was seriously affected, the average hæmoglobin being only 50 to 60 per cent of the normal, while anæmia caused no less than 15 per cent of the total mortality, but has been reduced by a vigorous campaign to one-eighth of the former total. In Fiji the treatment of 2000 Indian immigrants reduced the death-rate of adults from 36·7 to 19·46, and (of children from 136·7 to 116 per cent, within a single year. In Costa Rica the working powers of the labour force rose by 14·6 to 27 per cent after treatment, and on one estate 33 per cent more work was done at 15 per cent less cost. A careful study of the effect of hookworm infection on intelligence in children showed a distinct decrease due to slight infections, while heavy worm incidence produced a loss of from 16 to 24 months' educational progress. All the above data show the serious effects of ankylostomiasis and the great improvement in the prognosis obtainable by efficient treatment.

In advanced cases with general anasarca, sometimes including ascites, the prognosis is grave, as even removal of the worms may leave the patients too debilitated to recover, and they easily succumb to any intercurrent disease such as pneumonia, etc. In typical cases the red corpuscles may commonly be reduced to under 2,000,000, and the hæmoglobin to about 20 per cent, the colour-index being always low, often below 0·5, yet recovery may take place under careful treatment. Extremely low blood-counts, together with excessive dropsy, loss of digestive power, and albumin in the urine, are of grave prognostic significance, and any complication, such as malaria, adds to the gravity of a case. There are few diseases in which the prognosis is so rapidly improved by adequate treatment with one of the effective vermifuges ; but in advanced cases caution is required in giving large doses of the more drastic remedies, such as thymol and beta-naphthol.

Leonard Rogers.

ANTHRAX.—The outlook in cases of malignant pustule is much better now than in days gone by, and has been still further improved by the introduction of antitoxic sera such as Sclavo's and Mendez's. In the years 1850–1886, Koch reported a mortality of 39 per cent, and in 1905 Legge estimated the English mortality as 26·5 per cent (261 cases), and the German as 13 per cent (446 cases). Since that time Heinemann has collected statistics which show a marked improvement, and give us some guide as to the relative value of different methods of treatment. He collects from the literature :—

268	cases treated by various ointments and lotions	9·3	per cent died
814	„ „ excision, cautery, caustics	7	„
1073	„ (Buenos Aires) treated by Mendez's serum	4·2	„
80	„ treated by Sclavo's serum	3·7	„

The mode of obtaining these figures probably makes them too favourable, as literature reports are notoriously apt to publish the successes and let the failures drop into oblivion ; but many years ago Lengyel and Koranyi, in a consecutive series of 146 cases treated surgically, were able to report a death-rate as low as 9 per cent, so probably it is fair to take the mortality in the serum cases as 5 per cent, and in those treated by excision as 8 to 10 per cent.

The following table is derived from a report, published in 1921, of the Medical Inspector of Factories for Great Britain, with the conclusion appended that excision is not necessary :—

Treatment	Cases	Deaths	Mortality per cent
Serum only - - -	200	8	4
Excision only - - -	397	44	11
Excision and serum - - -	174	25	14·4
No special treatment - - -	29	14	48·3

The figures for Guy's Hospital from 1909 to 1919 have been published by Ogilvie and Hall as follows :—

Treatment	Cases	Deaths	Mortality per cent
Serum only - - -	4	1	25·0
Excision only - - -	6	1	16·6
Excision and serum - - -	37	3	8

They claim, therefore, that the combination of methods is the best. In appraising the statistics it should be borne in mind that the worst cases would probably have most done for them. Only mild cases would be given serum alone.

Much depends, of course, on the time at which the patient is first treated, these good results being only obtained in early cases. If the patient dies, it is usually in five to eight days, and spontaneous cure is said to be quite uncommon. It would be difficult to verify this statement nowadays, because every case seen would be treated.

When œdema is very great, the prognosis is unfavourable, and wounds of the head and neck are more than twice as dangerous as those of the limbs. When the temperature is high and the patient shows marked signs of systemic infection, recovery is unlikely.

Woolsorters' disease, that is, a general infection either of the lungs or intestine without a skin pustule, is happily rare, but is extremely fatal.

REFERENCES.—Heinemann, *Deut. Zeits. f. Chir.* 1912, 309; *Circular* 172, Ministry of Health, 1921; Ogilvie and Hall, *Brit. Med. Jour.* 1921, June, 889. A. Rendle Short.

ANTRUM, AFFECTIONS OF.—(See JAWS, TUMOURS OF; NASAL ACCESSORY SINUSITIS.)

ANUS, IMPERFORATE.—Many years ago, Harrison Cripps made a study of the operation mortality in this condition under various circumstances. He pointed out that although the prognosis apart from operation is, of course, hopeless, except in cases where the rectum opens into the vagina, yet occasionally the children may survive for a surprisingly long time; one infant at St. Bartholomew's Hospital, whose parents refused operation, was still alive a month later, vomiting fæces three times a day!

MORTALITY IN NINETY-EIGHT CASES TREATED BY DIFFERENT OPERATIONS.

Operation	Cases	Deaths
Dissection from the perineum -	37	14
Puncture from the perineum -	17	14
Coccyx resected -	8	5
Opening into vagina -	14	1
Iliac colostomy - - -	16	11
Lumbar colostomy - -	3	2
Miscellaneous - - -	3	3

A study of 37 cases of this condition, treated at St. Thomas's Hospital, shows how few of the infants grow up to adult age in reasonable comfort. An exception must be made in favour of little girls with imperforate anus and recto-vaginal fistula. These survive, and at a later period a plastic operation can be performed. It will be very difficult to get control without stricturing, however. The writer has seen one such patient treated with fair success.

Of the 37 cases referred to, 20 died in hospital: 2 of peritonitis, 5 of shock, and 13 after laparotomy or colostomy. Of the 17 who left hospital alive, 10 have been lost sight of. Of the other 7, 2 died, age nine and twelve months respectively, of deaths probably unconnected with the anal condition; 1 died, age two months, of 'wasting'; 1 died, age four months, of intestinal obstruction; 1 died, age three years, after operation to close a colostomy; 2, age nine and seven years respectively, are still living, one quite well, the other with a recto-urethral fistula.

Cripps gives case-histories of a number of successful recoveries.

It is probably fair to conclude that about half the patients operated on die almost at once, and that about half of the survivors die in early infancy. A quarter of the total might survive, as far as the anal trouble is concerned, but some of these are in permanent discomfort. The most favourable cases are those with only a mere septum separating the bowel and the anus, but it will be seen that one child lived to the age of three years, even with a left iliac colostomy.

REFERENCES.—Cripps, *Diseases of the Rectum and Anus*, 3rd ed.; *St. Thomas's Hosp. Rep.* 1911, 156. A. Rendle Short.

AORTA, DILATATION OF.—Either in relation to thoracic symptoms, or in the course of routine examination, it is no uncommon experience to find evidences of diffuse dilatation of the aorta. The introduction of skiagraphy has done much to enlighten us as to the frequency with which the thoracic aorta is dilated. While it would be out of place to enter fully into the pathogenesis of this condition, it is essential to have some

understanding of the factors which enter into its production. These are two, the *dynamic* and the *degenerative*.

Dynamic Origin.—The simplest example of this kind is to be found in post-rheumatic insufficiency of the aortic valves; here there is little question of any degeneration of the aortic wall; for though the rheumatic process is liable to injure this structure, it seldom does so to any intense or abiding extent. Yet in many cases of long-standing aortic regurgitation, there are the clearest evidences of a diffuse enlargement of the arch of the aorta; so much so, indeed, that many writers have recorded such cases as examples of 'rheumatic aneurysms'. The explanation is not hard to find: each ventricular systole throws an excess of blood into the aorta and overdilates it. Clearly, there is no question of prognosis here apart from that of the disease itself.

Degenerative Origin.—This type of dilatation, on the other hand, is perfectly exemplified in syphilis of the aorta. Here we have to deal with an actual and progressive disease of the aortic wall.

Mixed Origin.—A combination of the two factors is encountered in cases of aortic dilatation combined with high arterial tension; in such cases the aorta stretches, partly because it is subjected to an abnormal tension from within, partly because it is—in most cases, at any rate—the seat of a dystrophic process. Even here, however, the latter factor is of minor importance; the fact that the aorta is dilated is of far less weight in regard to prognosis than the fact that the arterial pressure is raised.

It is clear, from this brief account of the etiology of aortic dilatation, that its bearing on the outlook of any given case is that of its cause, and it will be more profitable to refer the reader to the articles dealing with cardiac syphilis, arteriosclerosis, high arterial tension, and aortic regurgitation, than to encourage any attempt to forecast the future of a case without reference to the origin of the dilatation.

Carey F. Coombs.

AORTIC VALVULAR DISEASE.—(See HEART, CHRONIC VALVULAR DISEASE OF; RHEUMATIC ENDOCARDITIS.)

APHASIA.—The prognosis depends upon the underlying cause. Most cases of aphasia are the result of organic lesions of the cerebral cortex. In civilian life some of them are due to embolism from cardiac lesions; others, the majority, are due to arterial thrombosis; whereas cerebral hæmorrhage is relatively less common as a cause. Aphasia can also result from traumatic lesions, especially from war injuries. In embolic cases, the arterial obstruction usually reaches its maximum at once, and does not tend to extend. In thrombosis, on the other hand, there is a tendency for the lesion to spread and become more extensive, corresponding to the amount of disease in the cerebral arteries. Cerebral thrombosis occurring in the early half of adult life is most likely to be syphilitic in origin; whereas, after middle life, arteriosclerosis may occur, not only from syphilitic disease, but also from senile arteriosclerotic changes. Syphilis should always be looked for by the various tests at our command, since syphilitic cases have a better prognosis, if promptly treated, than non-syphilitic ones. Cerebral abscesses (most commonly in the left temporal lobe) and meningitis are among the less common organic causes of aphasia; whilst cerebral tumours are still more infrequent, producing aphasic symptoms either by direct infiltration of the speech centres or, more usually, by compression.

In many cases of aphasia from organic disease, there is a co-existent right-sided hemiplegia, more or less profound according to the situation and extent of the brain lesion. It is important, however, to remember that it is the cortical part of a brain lesion which is mainly responsible for the aphasic symptoms, and that deeper-seated lesions of the white matter may produce the most profound hemiplegia without any evidence of aphasia.

In organic lesions which are advancing—e.g., in spreading vascular lesions of any sort, in cerebral abscesses, meningitis, or tumours—aphasia is not likely to improve; on the contrary, it tends to get worse. But in cases where the organic lesion has come to a standstill—e.g., after an attack of cerebral embolism or thrombosis, after successful evacuation of a cerebral abscess, or after relief of pressure by removal of a cerebral tumour (provided the tumour has not infiltrated the speech centres, but only compressed them)—the speech centres, or so much of them as remains undamaged, may gradually

resume their function; whilst the subsidiary speech centres in the opposite side of the brain may, by education, undergo development.

The degree which such compensatory activity of the speech centres may attain is very variable. The prognosis is best in children; under the age of five or six years, provided no profound dementia be present, compensation practically always occurs, and the aphasia usually clears up completely. In old age, on the other hand, the probabilities of re-education of subsidiary speech centres are very remote, and little or no improvement is to be looked for. In early adult life, or middle age, individual variations are so great that an accurate prognosis in any particular case is well-nigh impossible. Patients with word-deafness are more difficult to re-educate than those with word-blindness. The co-existence of word-deafness and word-blindness in severe degree renders re-education impossible, while the absence of both word-deafness and word-blindness, as in simple motor aphasia, renders the prospects relatively much more favourable.

Temporary Aphasia.—A transient aphasia, usually slight in degree and evidenced mainly by a difficulty in naming objects, may arise from debility or exhaustion in an otherwise healthy person. In other cases, the condition is due to temporary slowing or stasis of blood in diseased cortical arteries; such attacks are to be regarded as warnings of threatened thrombosis, and call for energetic treatment of the arterial disease, especially if it be syphilitic in origin. Temporary aphasia also occurs from localized arterial spasm, the patient recovering suddenly and completely within a few hours. We also meet with it in general paralysis of the insane as part of a 'congestive attack'. Certain cases of migraine are preceded by an aura of temporary aphasia, usually accompanied by a subjective sensation of tingling in the right arm, face, and tongue, and followed by left-sided headache. Aphasia may also be present, for a short time, after the occurrence of an epileptic fit, doubtless owing to temporary cortical exhaustion. Lastly, we may have temporary aphasia in uræmia, from toxic affection of the speech centres.

J. Purves Stewart.

APLASTIC ANÆMIA.—(See ANÆMIA, APLASTIC.)

APOPLEXY.—(See STROKES.)

APPENDICITIS: Acute and Chronic.

ACUTE APPENDICITIS.

Results of Operation.—In the year 1912, 936 cases of appendicitis were admitted to the London Hospital. Among them were 38 cases which for one reason or another were not operated upon; 2 of these were moribund when they were admitted and died shortly afterwards. I have excluded these 38 patients, and completed a series of 1000 cases by adding 102 others, 70 men and 32 women, who were admitted to the hospital at the beginning of 1913.

Of the 1000 cases, 698 were operated upon during the attack, 302 during the quiescent stage. Of the patients who were operated upon, 32 died, which gives a mortality in all cases of 3·2 per cent. The mortality in the 698 acute cases was 4·3 per cent. Among the 302 operations performed between the attacks there were 2 deaths, a mortality of 0·7 per cent. These patients were suffering from actinomycosis of the appendix; death was due in both cases to extension of the disease, and did not follow immediately upon the operation.

Wilkie reports that 1469 cases of acute appendicitis were operated upon in the Edinburgh Royal Infirmary from October, 1910, to September, 1913. The total mortality was 7·3 per cent.

Stillman reports that in 965 cases of acute appendicitis operated upon at the Roosevelt Hospital, New York, during the years 1910–15, there were 46 deaths, a mortality of 4·8 per cent.

Beckman reports that out of 500 cases of acute appendicitis admitted to the Belle Vue Hospital, New York, 34 died—a mortality of 6·8 per cent.

Flint reports 370 cases of acute appendicitis. Among them were 176 uncomplicated cases; they all recovered. In 17 cases the appendix was gangrenous, but there was no abscess or general peritonitis; one case proved fatal. In the remaining 158 cases the

appendix was perforated and associated with abscess or general peritonitis ; 18 of these cases died. The total mortality was 5·4 per cent.

La Roque records the most remarkable series of cases which has been published so far. Out of 600 cases he only lost 4, a mortality of ·75 per cent. There were 101 cases of abscess, and 25 of diffuse spreading peritonitis. An abscess was present in 3 of the fatal cases.

I have divided up the 698 patients who were operated upon at the London Hospital during the acute stage into four groups, according to the condition found. In the first group are placed those patients who had general peritonitis ; there were 80 of these, 16 of whom died, giving a mortality of 20 per cent. In the second group are 211 patients who had an abscess ; 204 recovered and 7 died, giving a mortality of 3·3 per cent. In the third group are those who had local peritonitis only, including those cases in which the peritonitis was diffuse but did not involve the whole of the peritoneal cavity ; these numbered 123 with 6 deaths, a mortality of 4·8 per cent. Finally, in the last group are placed those patients in whom the inflammation was limited to the appendix and there was little or no evidence of local peritonitis ; in this group are 284 patients, 1 died ; a mortality of 0·3 per cent.

Table A.—PRESENT MORTALITY IN OPERATIONS FOR APPENDICITIS.

	Total	Recovered	Died	Mortality
During quiescent stage	302	300	2	per cent 0·7
During acute stage :				
General peritonitis -	80	64	16	20
Abscess - - -	211	204	7	3·3
Local peritonitis -	123	117	6	4·8
Inflammation localized to appendix -	284	283	1	0·3
Total -	698	668	30	4·3
Grand Total (all cases)	1000	968	32	3·2

From these statistics we can form some idea as to the prognosis in the different forms of acute appendicitis if the patient is submitted to surgical treatment ; and for easy reference I have collected them together in *Table A*. It is, however, far more important to draw attention to the way in which the prognosis varies according to the time at which operation is undertaken. I found on examining the statistics of the London Hospital, that out of 162 patients who were operated upon during the first twenty-four hours of an attack, only 2 died, giving a mortality of 1·2 per cent ; of cases operated upon during the second twenty-four hours of an attack, 152 in all, 6 died, a percentage of 3·9 per cent ; whereas of those in whom operation was postponed until the third day of the attack, 115 in all, 10 died, or 8·7 per cent. I do not think that any deductions can be drawn from the death-rate of the cases operated upon from the fourth to the ninth days, as the numbers are so small. But attention may be drawn to the fact that of the 58 patients operated upon on the tenth day or later, only 1 died. If *Table B* is examined for details of these cases, it will be seen that 40 were cases of abscess, and in 14 the inflammation was limited to the appendix ; in other words, that in 54 cases the condition was well localized ; there was therefore much less danger in operating upon them than in cases which were not so localized. These statistics illustrate the value of early operation, during the first twenty-four hours of the attack if possible, and the cases are sufficiently numerous to justify the statement that operation during the first twenty-four hours is attended with extremely little risk ; operation during the second day with considerably more risk, though it is still small ; but if operation is postponed until the third day, the prognosis is much more serious.

Some may argue that the results obtained in the operations on the tenth day or later are strongly in favour of postponing operation. The reply of course is that it is generally impossible to tell in which cases the inflammatory process will become localized and operation may be deferred with safety. I would once more point to the total mortality of 3·2 per cent in this series, compared with the total mortality of 17·2 per cent in another series of 1000 cases which I collected in 1905 ; at that time operation was very rarely performed in the first stages of the attack, but was postponed as long as possible in order to allow the attack to subside, or, failing this, to allow the inflammation to become localized.

Table B.—MORTALITY OF OPERATION ON THE DIFFERENT DAYS OF THE ATTACK.

Day of Attack	Inflamed		Local Peritonitis		Abscess		General Peritonitis		Total		Mortality per cent
	R.	D.	R.	D.	R.	D.	R.	D.	R.	D.	
1st day -	99	1	35	0	13	0	13	1	160	2	1·2
2nd day -	62	0	39	1	25	1	20	4	146	6	3
3rd day -	40	0	10	3	43	2	12	5	105	10	8·7
4th day -	22	0	10	1	10	0	6	1	48	2	4
5th day -	12	0	3	0	17	0	3	1	35	1	2·8
6th day -	5	0	4	0	11	0	1	0	21	0	0
7th day -	9	0	3	0	23	1	6	2	41	3	6·8
8th day -	4	0	1	0	5	0	0	0	10	0	0
9th day -	2	0	1	0	5	2	1	2	9	4	30
10th day or later }	14	0	3	1	40	0	0	0	57	1	1·7
Day not stated }	14	0	8	0	12	1	2	0	36	1	2·7
Total -	283	1	117	6	204	7	64	16	668	30	4·3

R=Recovered.

D = Died.

The earlier statistics illustrate the results of postponing operation, the present ones the result of operating early.

If all cases could be left with safety until the tenth day, the general mortality would be still lower than it is ; but unfortunately they cannot, and it becomes our duty to remove the appendix at a time when the risk is reduced to a minimum, that is, during the first twenty-four hours, a procedure which offers the prospect of a mortality of only 1·2 per cent.

COMPLICATIONS OF ACUTE APPENDICITIS.

Unfortunately it is by no means rare for the patient's convalescence to be delayed by certain complications which may arise during the attack. Thus we find that out of 698 patients operated upon during the acute stage, in 85, that is 12·2 per cent, various complications arose. Among them were 25 cases of faecal fistula, 22 cases of secondary abscess, 17 pulmonary complications, and 12 cases of intestinal obstruction ; 3 patients had more than one complication ; for example, of two of the cases of pleural effusion, one was associated with a subdiaphragmatic abscess and the other with bronchopneumonia—and the patient with empyema also had a subdiaphragmatic abscess.

That 12·2 per cent of all patients operated upon during an attack of appendicitis, or one in eight, should suffer from complications is very unsatisfactory, but even so it is a great improvement on former results.

The explanation of this improvement is easy ; there can be no doubt that it is due to operating early instead of waiting until the patient has developed an abscess or general peritonitis. For on investigating the 85 cases in which complications arose, we find that in all but six there was an abscess or peritonitis, general or local ; in the great majority an abscess or general peritonitis. Of the 6 cases in which the inflammation remained localized to the appendix, 1 was a case of intestinal obstruction in which the appendix

itself formed the obstructing band, and probably became gangrenous in consequence of the cutting off of its blood-supply by the stretching of the appendix and its mesentery.

Secondary Abscess.—Secondary abscesses form a large proportion of the complications, for, as will be seen on reference to *Table C*, a secondary abscess developed in no less than 22 of the 85 patients, apart from the four patients who had a subdiaphragmatic abscess. The majority occurred in the pelvis.

Table C.—COMPLICATIONS WHICH OCCURRED AMONGST 698 CASES OPERATED UPON DURING THE ATTACK.

Complications	No. of Cases
Secondary abscess - - -	22
Subdiaphragmatic abscess - - -	4
Fæcal fistula - - -	25
Thrombosis - - -	4
Pulmonary complications :	
(1) Empyema - - -	1
(2) Pleural effusion - - -	4
(3) Bronchopneumonia - - -	7
(4) Lobar pneumonia - - -	2
(5) Bronchitis - - -	3—17
Intestinal obstruction - - -	12
Pylephlebitis - - -	2
Cystitis - - -	1
Hæmatemesis, hæmaturia, purpura -	1
Total number of complications -	88
Total number of patients affected -	85*

* One of the patients with pleural effusion also had a subdiaphragmatic abscess, and another had bronchopneumonia. The patient with empyema had a subdiaphragmatic abscess.

Subdiaphragmatic Abscess.—A subdiaphragmatic abscess occurred 4 times. In 1 case it was associated with clear fluid in the right pleura, and in the other cases with a right empyema. All four occurred in old-standing cases ; in 2 there was general peritonitis, and operation was not performed until the fifth and sixth days of the attack ; in 2 there was an abscess. All the cases recovered.

These results are unusually good. Hoffmann quotes Körte, who collected 60 cases, with a mortality of 33·3 per cent. Barnard collected 76 cases : 40 lived and 36 died, a mortality of 47·4 per cent. Of these, 12 were not operated on, and they all died. Of the 64 who underwent operation, 24 died, a mortality of 37·5 per cent. But of the 21 consecutive cases operated upon by Barnard himself, only 17·7 per cent died, a proportion which is a truer representation of the mortality of subdiaphragmatic abscess at the present day. This is largely due to the pioneer work done by Barnard in this direction, and also to further advances in our methods of diagnosis and treatment.

We must regard a subdiaphragmatic abscess as a serious complication. For although the four cases mentioned above all recovered, the number is too small to justify any deductions as to the mortality of this condition ; nevertheless the fact that they all did recover is encouraging. (*See also* SUBPHRENIC ABSCESS.)

Fæcal Fistula.—A fæcal fistula is far more likely to occur in a patient who is operated upon late in an attack than in one who has been operated upon within the first forty-eight hours. It may result from any of the following causes :—

1. Direct extension of the gangrenous process from the appendix to the cæcum or ileum.
2. Imperfect occlusion of the appendix stump. This may occur in cases in which only part of the appendix has been removed, as the proximal part could not be discovered, or it may occur in those cases in which an invaginating purse-string suture, placed in the wall of the cæcum round the insertion of the appendix, has either cut through the inflamed and œdematous tissue or given way.

3. Actual tearing of the intestine at the time of operation.

4. Patches already ulcerated and eroded, which, when freed from the adhesions which support them, perforate.

5. The pressure of a drainage tube on the intestine. In cases of prolonged suppuration, this pressure, combined with sepsis, may give rise to ulceration of the intestine, with subsequent formation of a fæcal fistula.

Most of these fistulæ can be avoided by early operation; the following case may be given as an example.

About two years ago I operated upon a boy of 18, thirty-six hours after the onset of the attack. The appendix was gangrenous, and continuous with it was a gangrenous patch on the cæcum the size of a five-shilling piece. The appendix was removed, the gangrenous part of the cæcum invaginated, and the patient made a rapid and uninterrupted recovery. If an early operation had not been undertaken, a fæcal fistula would have been inevitable.

Of the 25 cases of fæcal fistula, there were only 4 in which the operation was performed within the first forty-eight hours. In the great majority of cases the fæcal fistula followed an old-standing abscess. In the present series, fæcal fistula occurred 25 times in 698 acute cases, or 3·6 per cent.

As regards prognosis, it appears, therefore, that in acute cases 3·6 per cent of patients will develop a fæcal fistula. If, however, the operation is undertaken within the first twenty-four hours, or even the first forty-eight hours, the chances of a fistula forming are so slight as to be negligible. Of the 25 patients with fæcal fistula, 3 died.

The fistula itself, as a rule, closes spontaneously, in the majority of cases within fourteen days. It is rarely necessary to operate; but if the fistula persists, the question of operation must be considered.

Thrombosis.—This is another complication which is met with less frequently than formerly. Thrombosis of the femoral veins occurred 4 times, twice on the right side and twice on the left. The symptoms usually occur from two to three weeks after the beginning of the illness. There is first a slight rise of temperature, the following day a little pain in the affected limb along the course of the vein, with probably slight œdema of the foot, and the next day the œdema becomes more marked.

The first case was that of a boy with a retrocæcal abscess, who had been ill for five days before his admission to the hospital; the second case, a man of 45, had an abscess and had been ill for ten days; in the third case, a man of 53, there was no abscess, but the operation was a difficult one and there were many adhesions. The fourth case was a man of 65, who had general peritonitis with a gangrenous appendix and who had only been ill for a day and a half. In the last case there is little doubt that the age of the patient and his feeble circulation predisposed to thrombosis. All four patients recovered.

In considering the prospect of a case of femoral thrombosis, one must remember the danger of its giving rise to pulmonary embolism, and bear in mind Hoffmann's statement that out of 39 patients who had femoral thrombosis, pulmonary embolism occurred in 22.

The ultimate prognosis of thrombosis of the femoral veins is good in young subjects, although the leg will probably remain œdematous for many months. Wearing an elastic bandage, and massage after a due interval, cause great improvement.

Pulmonary Embolism.—In connection with thrombosis we must consider the extremely important condition of pulmonary embolism. In 4000 cases of appendicitis, Hoffmann reported 39 cases of thrombosis of the femoral veins, and no less than 22 of these gave rise to pulmonary embolism, 18 of the 22 cases proving fatal. McWilliam, in 685 acute cases, found 4 cases of pulmonary embolism, of whom 3 died, on the third, ninth, and tenth days. If we take these two reports together, we see that out of 26 cases, 21 died, a mortality of 80·8 per cent.

Garré and Quincke allude to the varying mortality of pulmonary embolism in the statistics of different authors. They quote the following:—

Lotheissen found 52 deaths out of 61 cases = 83·3 per cent									
Albanus	„	10	„	„	23	„	= 43·5	„	
Gebele	„	11	„	„	14	„	= 79	„	
Wyder	„	8	„	„	12	„	= 66	„	

The difference is probably due to the inclusion of slight cases by some authors, while others only included cases in which the symptoms were pronounced and severe.

Pulmonary embolism is, perhaps, the greatest tragedy of surgery, and any treatment which is likely to prevent this calamity should receive most careful attention. Hoffmann has obtained remarkable results by making the patient stand up out of bed, even if only for a minute, the day after operation, and this is repeated on subsequent days. If it is quite impossible for the patient to stand, passive and active movements of the lower extremities are instituted and, later, massage. His statistics embrace all cases up to the year 1912, and this treatment was begun in the year 1908. After the introduction of this treatment there were only 3 cases of thrombosis and emboli, compared with 36 in the previous years, and none of these three had been made to get out of bed the day after operation. This is most suggestive, and the treatment is worthy of very careful consideration.

The mortality of severe cases of pulmonary embolism appears to be about 75 per cent; but as was pointed out by Sir Douglas Powell, in all probability many of the cases of bronchopneumonia, empyema, and pleurisy which arise as complications of appendicitis, are really embolic in origin. Fortunately, we can say that at the present time, with modern methods of treatment, fatal pulmonary embolism is an extremely rare complication of appendicitis.

In 4 cases the pulmonary artery has been opened and the clot removed by Trendelenburg's operation. The most successful case was a woman operated upon by Krüger; she lived for five days and a quarter after the operation, and died from purulent pleurisy.

Other Pulmonary Complications.—Pulmonary affections form a large proportion of the total number of the complications, viz., 17 out of a total of 88. Reference to *Table C* will show the relative frequency of the different conditions, bronchopneumonia heading the list, and pleural effusion coming second.

Empyema only occurred once, and then was in association with a subdiaphragmatic abscess.

Pleural effusion occurred in 4 cases. In one, the patient had been ill three weeks and had a subdiaphragmatic abscess. The second patient was operated upon for general peritonitis on the third day of the attack, and developed double pleurisy and bronchopneumonia. Both of the other two patients had local peritonitis, and the fluid was on the right side of the chest.

In the 8 other cases of bronchopneumonia and lobar pneumonia there was an abscess or peritonitis in 6. Bronchopneumonia developed in one case of acute appendicitis in which inflammation was limited to the appendix; and in another similar case, in which there were adhesions and free fluid in the peritoneal cavity, the patient had right lobar pneumonia.

A patient, age 64, who had a perforated appendix and was operated upon four days after the beginning of the attack, died from bronchitis and heart failure.

These results are striking evidence of the relation between late operation and pulmonary complications, and indicate the prophylactic value of operation during the first twenty-four hours of the attack.

Intestinal Obstruction.—Intestinal obstruction is a grave and not uncommon complication of appendicitis. I find that it occurred 12 times, that is, in 1.2 per cent of all cases, or in 1.7 per cent of the acute cases.

The obstruction may be either paralytic or mechanical. In the paralytic variety or ileus, there is paralysis of the intestine with resulting symptoms of intestinal obstruction. In my present series there were 5 examples of this condition, and 4 of them died. In its milder forms it is commonly met with, and therefore it is possible to assume that there were other cases in which ileus was present to a slight degree but no mention has been made of it. When ileus occurs in an attack of appendicitis it is always of grave prognosis, but less so when it occurs early in an attack than later. In the former condition, particularly when it is present before operation, it is often possible to overcome it by appropriate treatment; but when it occurs in the later stages, the prognosis is very grave. Much can be done to relieve the patient by turpentine enemata and the hypodermic administration of pituitary extract. Eserine, in $\frac{1}{100}$ -gr. doses every two

hours for four doses, is often effective, and may be combined with injections of strychnine.

An allusion must be made here to ileus duplex, a condition recently described by Sampson Handley. He says that in certain cases of pelvic peritonitis, paralysis and consequent obstruction occur in two separate portions of the intestines lying in the pelvis—firstly in the lower two or three feet of the ileum, extending to within two inches of the ileocaecal valve, and secondly in the lower part of the pelvic colon and upper part of the rectum. The affected coils are empty, passively contracted, and motionless; the bowel wall is swollen and oedematous. Handley recommends that an anastomosis should be made between the ileum above the affected part, and the ascending colon, and that a caecostomy should be performed at the same time.

Mechanical obstruction occurred in 7 cases, of which 5 recovered and 2 died. It may be due to the presence of adhesions, producing a kink in a piece of intestine, or adhesions may take the form of a band, and form a loop round a piece of intestine and so ensnare it; or a loop of intestine may pass underneath the band and become strangulated in that way. Lastly, the appendix itself is not very uncommonly the immediate cause of intestinal obstruction. I recently operated upon a patient in whom the tip of the appendix was adherent to the root of the mesentery; it had formed a loop, and through this loop a piece of intestine had passed and was tightly gripped. Not only was the intestine gangrenous, but also the appendix itself. When the appendix forms the constricting band, the prognosis becomes rather more serious, as not infrequently the stretching of the appendix has cut off its blood-supply, and gangrene has followed, with resulting general peritonitis. In these cases the primary condition appears to be that of intestinal obstruction, with secondary gangrene of the appendix.

Ruge found 44 cases of intestinal obstruction in 2385 cases of appendicitis, a proportion of 1·8 per cent, which is not very far from the proportion of 1·2 per cent in my cases. Among these 44, there were 14 cases of ileus, 7 of which recovered and 7 died. In the other cases the appendix itself formed the constricting band in no less than 6; of these only 2 recovered, and 4 died.

The frequency with which intestinal obstruction occurs depends largely on the time at which the primary operation is performed, as is the case with nearly all the other complications of appendicitis. It is interesting to note that in all of my 12 cases either an abscess or general peritonitis existed. None of these cases had been submitted to what is known as early operation, that is, within the first twenty four hours, or even the first forty-eight hours. The real secret of successful treatment of intestinal obstruction in appendicitis is to prevent its occurrence.

The prognosis is grave. Out of the 12 cases in the present series, 6 recovered and 6 died, while out of Ruge's cases 23 recovered and 21 died—a total of 29 recoveries and 27 deaths, giving the high mortality of 48·2 per cent.

In discussing intestinal obstruction due to appendicitis, one must bear in mind the possibility of an attack of appendicitis leaving behind it bands and adhesions, which may cause intestinal obstruction at a later date.

Jaundice.—Speaking generally, when jaundice complicates an attack of appendicitis, the prognosis is grave.

Hoffmann has recorded 11 cases; in nearly all of them there was acute perforative appendicitis; in several, diffuse peritonitis or extensive abscesses. He regards jaundice as a sign of very severe illness, especially if it appears early in the attack.

Reichel thinks that jaundice may arise from the spreading of infectious material, and therefore advises that in the case of an abscess one should be content with opening it, and nothing more, when the disease has existed forty-eight hours. Eight of his 18 patients who had jaundice recovered—a mortality of 55·55 per cent; but of Aldehoff's 14 cases, 11 recovered and only 3 died.

Jaundice may be due to various causes and may appear at various stages of the illness. The following are the principal causes: (1) Simple catarrhal jaundice; (2) Toxæmia; (3) Direct extension of the inflammation from the appendix to the gall-bladder and biliary ducts; (4) Pylephlebitis; (5) The so-called delayed chloroform poisoning.

1. *Simple Catarrhal Jaundice.*—I recently saw a case of this sort in which the patient's

illness began with vomiting; catarrhal jaundice shortly followed, and next day pain began in the right iliac fossa. Operation was performed within thirty-six hours and an acutely inflamed appendix removed. The jaundice followed the usual course of catarrhal jaundice and subsided in the usual way, after a brief period in which the stools were clay-coloured, the urine contained large quantities of bile pigment, and the skin and sclerotics were deeply tinged with yellow. This is the least serious form, and may be met with in varying degrees; in some cases there is merely a slight and evanescent tingeing of the sclerotics, but in others, as in the case just described, the patient may pass through a typical attack of catarrhal jaundice.

2. *Toxæmia*.—The second class consists of cases in which the jaundice appears to be the result of toxæmia. A good example of this kind has been described by Holländer. The patient had well-marked jaundice with an appendix abscess. The abscess was opened and drained, and a gangrenous appendix removed. The jaundice disappeared within two or three days. In consequence of his experience in this case, Holländer suggests that when jaundice is present in cases of acute appendicitis, it indicates that the appendix is gangrenous. There are also mild cases in which the jaundice appears in the early stages of the attack and passes off shortly after operation; they probably belong to this class also.

3. In the third class are placed cases in which there is a *direct extension of inflammation of the appendix to the gall-bladder*, and numerous adhesions are found about the gall-bladder.

4. *Pylephlebitis*.—The fourth class is composed of cases which are still more serious. I refer to those in which the jaundice is due to portal pyæmia or acute pylephlebitis. These cases are fortunately rare. In the 1000 cases which I collected in 1905, there were 4 of pylephlebitis, all of which died. In the present series there were 2 cases, one of which was due to actinomycosis. It is, however, important to remember that jaundice is not always present in these cases. In neither of the 2 reported by Bidwell, one of which recovered, was there jaundice.

The diagnosis of the condition is generally easy. The usual history is that of an attack of acute appendicitis, the formation of an abscess, and after a varying interval the onset of rigors, and a few days later the appearance of jaundice. A little later still the liver may enlarge and become tender. It is interesting to note, however, that this is by no means invariably the sequence of events. I remember a patient who was, some years ago, in the London Hospital under my care with jaundice, enlargement of the liver, and tenderness in the region of the gall-bladder. There was a history of an acute attack of pain on the right side of the abdomen three weeks previously; the temperature was raised. A diagnosis was made of acute cholangitis secondary to gall-stones; but operation proved that the patient had pylephlebitis with a small retrocæcal abscess and a perforated appendix.

I have been rather struck, in the few cases which I have met with, by the comparatively mild local signs of appendicitis; but this cannot be taken as the rule, for in 7 cases reported by Hoffmann, 2 followed acute appendicitis, 3 after incising an abscess, and 2 after operation for diffuse peritonitis. Sasse, however, reports 2 cases in which the appendicitis was of such a mild type that the patients were not confined to bed; but about ten days after the beginning of the attack they developed symptoms of pylephlebitis, and died a few days later. The gravity of the condition lies in the fact that, as a rule, the liver is riddled with small abscesses, and so is beyond surgical treatment. Of Hoffmann's 7 cases, in only 2 was there an abscess sufficiently large to be incised; one of these recovered, but the other patient died. In my own experience I have had 2 cases which recovered, one of them a patient with a large abscess, which was drained, and the other a case of considerable interest, in which, on exposing the liver, I found numerous small abscesses the size of a pea or less; the *Staphylococcus pyogenes aureus* was found in pure culture, a vaccine was prepared, and the patient made a good recovery.

While the prognosis in cases of pylephlebitis is necessarily grave, it is not hopeless; an exploratory operation should be performed, and the condition found dealt with by drainage where possible, otherwise by vaccines. It goes without saying that in these cases the primary focus of the disease, namely, the appendix, should always be removed.

With regard to prophylactic treatment, Wilms has published a very remarkable case in which he ligatured the efferent veins leading from the appendix. This patient had had five rigors; but after the veins were ligatured the rigors ceased and the patient

made a good recovery, without gangrene of the intestine or any interference with peristalsis. Sprengel attempted to carry out a similar operation in a patient upon whom he had operated and from whom he had removed a gangrenous appendix thirty-six hours after the beginning of the attack. Nine days after removal of the appendix the patient had a rigor, and subsequently, two or three every day. Sprengel's attempts at ligature were unsuccessful, and a fæcal fistula developed at the lower end of the small intestine, probably due to gangrene through interference with the circulation. As he points out, the operation is likely to be difficult enough in a normal subject in the absence of inflammation, if there is no mesentery to the colon, and where there is a large amount of subserous fat; but if, in addition, the structures round the appendix are acutely inflamed, it becomes almost impossible to isolate the veins; and even if the veins are secured, the danger of ligaturing the arteries as well, and so giving rise to gangrene, is very great.

5. Delayed Chloroform Poisoning.—In the last class I would place cases of so-called delayed chloroform poisoning. This most distressing condition I have met with in varying degrees on several occasions, but fortunately have only lost one patient through it. This was a considerable number of years ago, shortly after attention had first been drawn to the disease.

The patient was a little girl of eleven, upon whom I operated and removed an inflamed appendix within thirty-six hours of the onset of the attack. Chloroform was given and the operation was straightforward, but twenty-four hours afterwards she began to vomit. The vomit at first consisted of ordinary gastric contents, but later it contained altered blood and became coffee-ground in character. With the onset of vomiting her mental condition became a little clouded; later she became delirious and, finally, comatose. Jaundice set in thirty-six hours after the operation, and at the end of forty-eight hours was well marked; it was not limited merely to the sclerotics, but extended over the whole body. The breath smelt strongly of acetone, the temperature was slightly raised, the pulse-rate steadily increased in rapidity and became proportionately weaker, and the respirations towards the end were irregular and approximated to the Cheyne-Stokes rhythm. The abdominal condition appeared to be entirely satisfactory; the abdomen moved well on respiration, was soft, and there was no distention. She died sixty-four hours after the operation.

This was a typical case of so-called delayed chloroform poisoning. The first symptom is usually vomiting, which comes on for no obvious reason about thirty-six hours after the operation, and the case is frequently fatal within forty-eight hours from the onset of the vomiting. I must, however, point out that jaundice is not present in all these cases.

It is not necessary to enter here into the various theories. Guthrie, however, says that children who suffer from cyclical vomiting are particularly liable to be victims of post-anæsthetic poisoning, and that the administration of an anæsthetic on the eve, or during an attack, of cyclical vomiting is attended by grave risk, and should be avoided if possible. With regard to prophylaxis, it is particularly important in the case of children not to starve them, and not to purge them too violently before the operation. Dextrose and soda bicarbonate should be given before and after the operation. With regard to the prognosis in these cases, many of them recover after prompt treatment by the administration of large quantities of dextrose and soda bicarbonate, and the mortality is far less now than it was before attention had been drawn to the condition and the proper treatment realized. (*See also ACIDOSIS, and ANÆSTHETICS, p. 38.*)

Pylephlebitis.—This has been discussed at sufficient length in Class 4, above. Apart from a case of actinomycosis, there was only one case in the present series, and this fortunately recovered. Jaundice, although present in a certain number of cases, is not necessarily a feature of pylephlebitis.

Gastro-intestinal Hæmorrhage.—Melæna or hæmatemesis occurring in a patient suffering from acute appendicitis is a matter of grave importance, all the more so as in the majority of cases it is impossible to relieve the condition by surgical methods. In some cases the hæmorrhage comes from a duodenal ulcer, in others from the stomach, either from a gastric ulcer or from numerous small erosions; in other cases again, it may be impossible to say where it comes from, even on post-mortem examination.

Three or four years ago I operated on a patient suffering from an attack of appendicitis with a large pelvic abscess. He had been ill for two weeks. At the operation

I removed the appendix and drained the abscess. All went well until five days after the operation, when he suddenly collapsed; his face became blanched and his pulse almost imperceptible. He improved under appropriate treatment, and shortly afterwards passed an offensive motion containing a very large quantity of altered blood; during the subsequent week he had several similar attacks, though less severe. All this time he had melæna, frequently three or four motions in the twenty-four hours. The question of operation was raised, but negatived, as his condition was such that any operative interference would almost certainly have proved fatal, apart from the fact that it was impossible to decide the source of the hæmorrhage. Fortunately it gradually ceased, and he ultimately made an excellent recovery.

Hoffmann reported 7 cases of severe gastro-intestinal hæmorrhage. In 3 patients there was general peritonitis at the time of operation, in 1 there was an abscess, and the other 3 were operated upon at an earlier stage. Only one patient recovered; of the other 6 cases, in 2 the hæmorrhage came from a recent gastric ulcer; in another there was serious erosion of the gastric mucosa; in a third the post-mortem showed no cause for the severe hæmorrhage; one patient died from hæmorrhage in a few hours, seven days after a smooth appendicectomy in the acute stage—there was no post-mortem examination; the seventh case was a boy who was making a straightforward recovery from general peritonitis, and died suddenly from severe hæmorrhage—the post-mortem examination revealed a duodenal ulcer, with erosion of the splenic artery.

In 1908 Schwalbach collected 28 cases of gastro-intestinal hæmorrhage after operations for appendicitis, and added 2 of his own; 17 patients died and 13 recovered. The mortality in his series was directly proportionate to the severity of the appendicitis: 9 patients had diffuse peritonitis—they all died; 8 patients had an abscess with localized peritonitis—5 died and 3 recovered; 6 patients had acute appendicitis with only slight peritonitis—of these, 3 died and 3 recovered; 7 patients were operated upon during the quiescent period—these all recovered. One-third of the cases occurred in children. Schwalbach thinks that the hæmorrhage is the result of thrombosis in the venous and arterial circulation in the omentum and mesentery.

Fortunately this is a rare complication; it only occurred once in my present series of cases, and the patient recovered. If, however, a patient who has been operated upon for acute appendicitis has an attack of gastro-intestinal hæmorrhage, the prognosis becomes grave in direct proportion to the severity of the appendicitis.

With regard to treatment, if from the previous history of the patient there is good reason to suspect the existence of a chronic duodenal or gastric ulcer, and his general condition is satisfactory, surgical intervention is strongly indicated.

Hæmaturia.—Hæmaturia is a rare but interesting complication of appendicitis, and although its pathology is still somewhat obscure, the hæmorrhage is probably due to a *Bacillus coli* pyelitis. Slight hæmaturia may be caused by the rupture of an appendix abscess into the bladder, but the amount of blood is, as a rule, very slight, and there is but little difficulty in making the diagnosis. On the other hand, a number of cases have been reported in which hæmaturia occurred on several occasions after an attack of pain in the right side of the abdomen, and the condition was supposed to be one of renal colic. It was only later, when symptoms of appendicitis definitely declared themselves, that the true diagnosis was made, and the patient was cured by removal of the appendix.

Cases of hæmaturia in appendicitis may be roughly divided up into two main groups. In the first may be placed those cases in which the appendix does not lie in contact with any part of the genito-urinary tract, and in the second, those in which the diseased appendix is actually in contact with the kidney, ureter, or bladder. In 6 out of 15 cases discussed by von Frisch, the appendix was adherent to the lower part of the ureter.

As a general rule, the hæmaturia follows an attack of pain in the right side of the abdomen, and in a few cases the colic and hæmaturia are brought on by violent exercise. Occasionally the hæmaturia is preceded by little or no pain.

The following case described by Hammersley is fairly typical. A lady had attacks of vomiting, with shivering and colic, every three months. Two days after the beginning of each attack, blood appeared in the urine, and on one occasion the urine appeared to be almost pure blood. The attacks were brought on by unusual bodily exertion. On examination, nothing abnormal could be detected, apart from a movable right kidney;

the kidney was not painful or enlarged. There was no tenderness in the appendix region. Ultimately an attack occurred which was associated with a rise of temperature, and tenderness in the right iliac fossa was present for the first time. The appendix was removed, and was found behind the cæcum, adherent to the right kidney and ascending colon. The patient had no further attacks of colic or hæmaturia. A somewhat similar case in which the colic and hæmaturia followed exertion has been described by von Frisch.

In other cases, as in a boy under my care some years ago, hæmaturia may supervene without any severe attack of pain. I saw my patient, a boy of twelve, during his second attack of hæmaturia. No tenderness was to be made out on abdominal examination; the kidney was not enlarged; there was no rise of temperature. On examination with the cystoscope, blood was seen coming from the orifice of the right ureter. On examination of the urine, the *Bacillus coli communis* was found in pure culture. The hæmaturia rapidly subsided. Two months later I operated upon him for what was supposed to be his first attack of appendicitis; but on removing the appendix I found it to be the seat of old-standing disease. In this case the appendix was not in contact with the kidney, ureter, or bladder. The patient remained well and had no further hæmaturia.

It is interesting to note that in the majority of cases nothing abnormal is to be found in the urine apart from the blood. This is found in varying quantities, and it is not uncommon to find blood-casts in addition to altered blood-corpuscles. The most striking feature of the condition, however, is the way in which the hæmaturia clears up after removal of the appendix, and does not recur.

As for the explanation of the hæmaturia, in some cases there can be no doubt that there is a direct spread of the infection to the kidney, as in a case reported by Seelig, in which a perityphlitic abscess and a gangrenous appendix lay on the kidney.

When the appendix is adherent to the ureter, it may cause venous congestion and consequent bleeding from the mucous membrane of the ureter, or inflammation and swelling of the mucous membrane, which may give rise to obstruction of the ureter and so predispose to acute pyelitis and hæmaturia, as in the cases recorded by Hunner.

These two theories will not, however, account for cases in which the appendix is not in contact with any part of the urinary tract. They must probably be explained either on the ground that there is a toxic nephritis, or that the kidney is the site of emboli or thrombosis. Von Frisch thinks that the hæmaturia is probably due to embolism or thrombosis, the presence of blood-casts supporting this theory; he suggests that a retro-grade thrombosis may take place, owing to the free communication between the veins of the capsule of the kidney, the veins of the peritoneum, the lumbar, and the retro-peritoneal veins.

Anschütz described four cases of hæmaturia which occurred in children between the ages of ten and fourteen. In each case there was acute suppurative appendicitis with peritonitis. The hæmaturia appeared from three to four weeks after the beginning of the illness. In two cases it was associated with severe colicky pain in both kidney regions, in the third case the pain was on the left side only, and in the fourth there was no pain at all. Red blood-cells and blood-casts were invariably found in the urine. All four patients made a complete recovery. Anschütz attributes the hæmaturia to an acute circumscribed toxic nephritis.

The prognosis in the hæmaturia which is usually associated with appendicitis is excellent, as these cases clear up as soon as the appendix has been removed, leaving no trace, as far as we know, of any after-effects.

BACTERIOLOGY.

There is no doubt that the great majority of cases of appendicitis are due to the *Bacillus coli communis* and *Streptococcus pyogenes*, either separately or together. In most cases the former is to be found alone, in others the *Bacillus coli* and *Streptococcus* in pure culture. Other organisms, both aerobic and anaerobic, are sometimes found, but they usually play a subsidiary part and only represent a secondary infection.

The prognosis in the case of a streptococcal infection is, as a rule, more serious than in the case of infection by the *Bacillus coli*. Kelly states that the *Streptococcus pyogenes* is especially associated with cases of very severe infection, and is the usual cause of extensive and rapidly fatal peritonitis. This fully bears out my own experience, and I have

frequently found it present in cases of severe infection, with gangrene of the appendix and possibly extension to the caecum. Those cases in which the temperature remains raised for a week or ten days after removal of the appendix, in spite of apparently satisfactory drainage, are not uncommonly due to streptococcal septicæmia. If the abdomen is explored, but little pus will be found, and what there is is present in small loculi. If the adhesions are broken down to let out these small collections of pus, there is a great danger of fecal fistula.

PREGNANCY.

There has been a good deal of discussion on the relation between pregnancy and appendicitis, and their influence on each other; but the number of cases reported is comparatively small, and it is difficult to draw any satisfactory conclusions. In the present series there were only 2 patients who were pregnant, one three months and the other six months. In one the appendix was inflamed, without formation of pus or peritonitis; the wound healed by first intention, and the patient made an excellent recovery. In the other case the illness was of longer duration, and there was local peritonitis at the time of operation; but the patient recovered, pregnancy being undisturbed.

If a patient recently recovered from an attack of appendicitis becomes pregnant, is she likely to have a recurrence of the appendicitis during her pregnancy? Apart from the ordinary probabilities of a recurrence of an attack of appendicitis independently of pregnancy, we have to take into consideration the altered intra-abdominal conditions. These have given rise to a good deal of speculation on the part of various authors, with the result that exactly opposite opinions have been held. On the one hand, we can say that the constipation which is so frequently present in pregnancy is a predisposing factor, and would favour an attack of appendicitis. On the other hand, the connective tissue in the lower abdomen becomes looser and all the parts more vascular, which would not favour such an attack. But when we take into consideration the actual facts, we see that the number of women who suffer from appendicitis during pregnancy is extremely small. For example, among the 1000 cases of appendicitis which I collected in 1905, there were 309 females, and 6 of them were pregnant, a proportion of, roughly, 2 per cent. In the present series there were 394 females, 2 being pregnant, a percentage of about 0.5 per cent. This proportion is somewhat larger than that which obtains in the statistics of Sonnenburg and Krogius, quoted by Renvall. Sonnenburg, among 2000 cases of operation for appendicitis on both sexes, had 4 cases of pregnancy, and Krogius, in 900 cases, had 1 of pregnancy. Renvall also quotes Fraenkel, who, out of 40,000 gynæcological and obstetric cases, had only 4 cases of appendicitis associated with pregnancy, and Schauta, who had 4 cases out of 30,000.

Now although it is obvious that when the total period of the pregnancies of any one woman is taken, it forms only a very small part of her life, the number of pregnant patients in the above statistics is so exceedingly small that it suggests that pregnancy does not have any particular influence in predisposing to an attack of appendicitis. Further, Renvall found that attacks of appendicitis, whether primary or secondary, depend but little, or not at all, on the month of pregnancy, because the number of cases which occurred in the second and third months, when the uterus can exert no pressure and no traction on the appendix, was proportionately equal to those which occurred in the later months of pregnancy. We may therefore consider that the influence of pregnancy on the incidence of appendicitis is not proved.

We next pass on to consider the probable course of events in a patient who has an attack of appendicitis during her pregnancy. First of all, one can say without hesitation that if operation is performed in the early stage, that is, within the first twenty-four hours, the prognosis differs very little from that in a patient who is not pregnant, and the same holds good for a certain number of cases of abscess, namely those which do not come into contact with the uterus. If, however, the uterus forms part of the wall of an appendix abscess, the prognosis becomes more serious. The great danger, of course, is the possibility of miscarriage or labour; for the rapid diminution in the size of the uterus will break down the adhesions and flood the peritoneal cavity with the pus which escapes from the abscess. Several cases have been reported in which the patient died from general peritonitis, the result of a ruptured appendix abscess, two or three days after labour.

With regard to the effect on the pregnancy, a simple appendicitis does not necessarily predispose to abortion or labour. On the other hand, if an abscess has formed, the prospects are not so good, for if it lies in contact with the uterus there is a considerable probability that it will bring about miscarriage or labour, a probability which becomes a certainty if there is general peritonitis. At the same time it must be remembered that abscesses have been evacuated without disturbing the pregnancy.

Lastly, with regard to the child: in nearly all cases in which appendicitis puts an end to the pregnancy, the child is born dead, or dies within a few hours of its birth. An interesting case has been reported by Pinar, in which the *B. coli communis* was found in pure culture in the vessels of the umbilical cord. Krönig also reported a case in which the *B. coli communis* was found in pure culture in the organs of the fœtus, in the placenta, and in the large uterine veins.

What then is the best line of *treatment* to adopt in a patient who becomes pregnant shortly after an attack of appendicitis? If the attack was a severe one, I think that she should be advised to have the appendix removed as soon as possible, for appendicectomy in the quiescent stage is attended with very little risk to the patient and is not likely to disturb the pregnancy. In this way, the danger of a recurrent attack during her pregnancy will be avoided, an attack which might be accompanied by abscess or general peritonitis, and which would possibly prove fatal to both mother and child. If, however, the attack was a very mild one, and therefore a recurrence less likely, and if the patient would be within reach of surgical aid during the whole of her pregnancy, then one might wait for a further attack to develop, on condition that operation should be performed as soon as the diagnosis had been made.

If an attack of appendicitis occurs during pregnancy, the safest course for both mother and child lies in immediate operation.

WHEN TO OPERATE.

We now have sufficient data to discuss the vexed question, when to operate in appendicitis. There is a steadily growing consensus of opinion that operation should be performed in all cases of appendicitis as soon as the condition is diagnosed; for at the beginning of an attack it is frequently extremely difficult to give a prognosis and to say whether the patient will get well without operation or not.

At one time it was said, "If the patient is not improving at the end of forty-eight hours, operate". My reply to this is, of course, that one should not wait until the end of the first forty-eight hours, but, once the diagnosis has been made, operation should be performed immediately. To emphasize this, we need only point to the figures given above, which show that the mortality in patients operated upon during the first twenty-four hours is 1·2 per cent, during the second twenty-four hours 3·9 per cent, and during the third twenty-four hours 8·7 per cent.

It may be objected that it is not necessary to operate upon all cases of appendicitis, and that many of them will subside without any operative interference whatever. This is perfectly true. The crucial point, however, is that, in most cases, we cannot tell at the beginning of an attack whether it is going to be a catarrhal one, or whether gangrene will set in. Any surgeon who has a fairly wide experience of operating on these cases can readily call to mind patients who presented symptoms and signs of a comparatively mild attack of appendicitis, but in whom a gangrenous appendix was found at operation. Kümmell, in discussing the importance of early operation, mentions that out of 237 cases upon which he operated during the first forty-eight hours of the attack, 115, nearly 50 per cent, showed a gangrenous or perforated appendix.

In some cases, however, as Wilkie and Irwin have pointed out, it is possible to distinguish between acute appendicular obstruction and acute appendicitis. One can then form some idea as to the prognosis, since the former condition is by far the more serious of the two, and in all probability will be followed by perforation and gangrene.

In acute appendicular obstruction, the pain at the onset of the attack is severe and spasmodic and referred to the umbilicus; there are vomiting and constipation, but the temperature and pulse are normal. A quiescent period follows in which the pain is less severe and only occasional, but the tongue is dirty and the breath offensive. The pulse-rate and temperature may now be raised slightly. With the exception of slight rigidity

in the neighbourhood of McBurney's point, abdominal examination is negative. The third stage begins in twenty-four to forty-eight hours from the onset of the attack, and is ushered in by a return of the pain, which may be even more severe than at first, and the symptoms rapidly become those of acute perforative peritonitis.

In acute appendicitis without obstruction, the pain at the beginning of the attack is not very severe; but it gradually increases in intensity, and is felt in the right iliac fossa. The pulse-rate is quickened, and the temperature raised from the first.

Apart from the very small mortality of operations performed during the first twenty-four hours, a point of great importance is this, that by operating early and removing the diseased focus, the chances of complications supervening are greatly diminished. This is particularly the case with such complications as ileus and the other forms of intestinal obstruction, thrombosis of the femoral veins, pyelephlebitis, and so on. For example, if we compare my 1905 series of cases with the present series, we find that the number of cases of fecal fistula has been reduced from 49 to 25, and of thrombosis of the femoral vein from 12 to 4. There were only 17 cases of pulmonary complications as opposed to 45 in 1905, and 2 cases of pyelephlebitis as opposed to 4. Further, with very few exceptions, all the complications in the present series occurred in patients who, at the time of operation, were suffering from either abscess or general peritonitis.

Another point in favour of early operation, apart from the prevention of such grave conditions as the formation of an abscess or general peritonitis, is that, in the great majority of cases, it is possible to close the wound and obtain union by first intention. Where an abscess or general peritonitis is already present, this is not possible, and we have to face the possible development of a ventral hernia, apart from the prolonged stay in bed which is necessitated by these conditions.

Lastly, another point of considerable importance in the prognosis is the fact that appendicitis is essentially a disease where relapse is the rule, and freedom from recurrence is the exception. The only cure is operation: medical treatment may be successful in tiding the patient over an attack, but the probability of recurrence is very great. Of 233 cases collected by Karrenstein, 50.2 per cent had further attacks, 60 per cent in the first year, 20 per cent in the second, and 20 per cent subsequently. Of 1933 cases, Kümmell found that 989, or 51.1 per cent, had had previous attacks.

When operation is performed in the early stages, the appendix can always be removed, and thus the possibility of further attacks is obviated.

RECURRENCE.

This question must be considered from three standpoints: (1) the probability of recurrence in a patient who has an attack of appendicitis, mild or acute, without abscess formation; (2) recurrence of symptoms after appendicectomy; (3) recurrence after an abscess when the appendix has not been removed. Statistics which are compiled at the present day have not the same value as those of five or six years ago, owing to the greater frequency of operative interference. For nowadays, not only is it the rule for a patient who has an attack of appendicitis to be operated upon, either immediately or at the conclusion of the attack; but also many cases of chronic appendicitis, where there has never been an acute attack, are recognized and treated by operation.

The great tendency to recurrence is pointed out by Hoffmann, who found that of 2331 cases operated upon for appendicitis, no less than 1202, that is, 51.1 per cent, had had previous attacks, and this, he says, was the minimum, for in a large number of cases there was no mention as to whether the patient had had a previous attack or not.

I have already referred to Karrenstein's conclusions: we there see that, of patients who are going to have recurrent attacks of appendicitis, 80 per cent will have them within two years. But at the same time it must be borne in mind that attacks may recur after as many as eighteen, twenty, or even twenty-two years have elapsed.

It seems possible that as the attacks are repeated they become less severe. In 1905 I found that of 299 patients who had an appendix abscess, 187 had had no previous attacks. This is still more striking in the case of general peritonitis. Of 35 cases in which allusion was made to the presence or absence of previous attacks, in no less than 31 the patients had not had appendicitis. Three patients had had one attack, and 1 patient had had two attacks. That is to say, in 88.6 per cent it was the first attack.

Table D.—CASES OF ABSCESS AND GENERAL PERITONITIS ADMITTED TO THE LONDON HOSPITAL FROM JULY 1, 1900, TO AUG. 15, 1904, AND THEIR RELATION TO PREVIOUS ATTACKS OF APPENDICITIS.

	Number of cases	Number of previous attacks of appendicitis				
		Not stated	None	One	Two	Three or more
Abscess - -	499	200	187	67	19	26
General peritonitis	101	66	31	3	1	0
Totals -	600	266	218	70	20	26

These figures are, of course, small, and deductions from them must be made with some reserve ; but it is reasonable to assume that the adhesions which result from the first attack tend to limit the inflammation in subsequent ones to the immediate neighbourhood of the appendix.

If the patient has had one undoubted attack, an operation for the removal of the appendix should be undertaken as soon as convenient. In the present state of our knowledge it is impossible to say with certainty whether a patient will have further attacks or not ; but unless the recent attack was a very mild one, of brief duration, with little pyrexia or general disturbance, it is probable that he will. If it was a severe one, changes will probably take place in and around the appendix, resulting in a stricture, kinking, adhesions, etc., which predispose to a recurrence, and therefore operation is strongly indicated.

An exception may perhaps be made where the patient has had numerous fairly acute attacks of appendicitis, perhaps six or seven, and each has been less severe than the preceding one. If these cases are operated upon, it is usual to find the appendix partially destroyed, great fibrous thickening of the submucous coat, and the lumen almost or entirely obliterated for a great part of its extent. Adhesions are commonly met with which shut off the appendix more or less completely from the surrounding peritoneal cavity. A patient with an appendix in this condition is unlikely to have a very serious attack, and therefore, if strongly opposed to operation, he may be treated on medical lines. At the same time one must bear in mind the pathological conditions in the upper abdomen which are frequently associated with, and apparently caused by, chronic inflammation of the appendix. If there are symptoms of dyspepsia the appendix should certainly be removed, lest worse befall.

Recurrence of Symptoms after Appendicectomy.—Sir Frederick Treves went fully into this question in 1905, and made a valuable contribution to the subject by analyzing the cases of 45 patients who consulted him because they were no better for the operation, or still had ‘attacks’ which had been unaffected by the removal of the appendix. In the following table he gave a list of the patients who consulted him, and the varying conditions which gave rise to their symptoms.

Table E.—PATIENTS WHO COMPLAINED OF IMPERFECT RELIEF AFTER THE REMOVAL OF THE APPENDIX IN THE QUIESCENT PERIOD.

Appendix imperfectly removed	-	-	-	2
Ovarian trouble co-existing	-	-	-	9
Persisting or relapsing colitis	-	-	-	8
Persisting local pain	-	-	-	7
Neurasthenia or hypochondriasis	-	-	-	5
Continued attacks due to gall-stones	-	-	-	3
“ “ colic	-	-	-	2
“ “ movable kidney	-	-	-	2
“ “ stone in kidney	-	-	-	1
“ “ an unexplained cause	-	-	-	1
Tender mass in the right iliac fossa	-	-	-	5
				<u>45</u>

Reference to this table shows that in a large proportion of the cases the symptoms were not caused by appendicitis, but by various other conditions such as gall-stones, colitis, etc., and consequently the failure of the operation was due to an incorrect diagnosis. In 2 cases the whole of the appendix had not been removed, and the patient had further attacks in the stump which was left. In 5 cases the symptoms were ascribed to neurasthenia and hypochondriasis. In 5 other cases a tender swelling appeared in the right iliac fossa some time after the operation. In 3 of them the tender swelling was a fecal mass; in 1 it was inflammatory, and disappeared in a few weeks; in the remaining case it was due to tuberculous glands.

At Sir Frederick Treves's request I wrote to 363 London Hospital patients who had had the appendix removed in the quiescent stage. Among other questions, I asked if they had had any further attacks resembling those which they had had before the operation. There were 242 replies: 231 said that they had been quite free from pain; 11, a proportion of 4.5 per cent, said that they had had further attacks.

Among the patients who had the appendix removed during an operation for general peritonitis or abscess, the percentage was rather higher, as out of 107 patients who replied, 6, or 5.6 per cent, complained.

It is not surprising to find a higher percentage of imperfect relief in the latter circumstances, on account of the gross intraperitoneal disturbance, and also because of the increased difficulty of removing the appendix in the case of an abscess, especially if there have been previous attacks.

In 2 of the patients to whom I wrote, a second operation was necessary to remove the remains of an appendix which had been incompletely removed at the first operation; in one of them, removal of the appendix was originally attempted during a quiescent period, in the other, during an operation for abscess.

While giving adequate weight to the above investigations, it is important to remember that they were made fifteen years ago, and that since then we have made enormous strides in our knowledge of appendicitis, and in its diagnosis and treatment.* We may therefore reasonably suppose that a considerable proportion of the causes which were responsible for the lack of success of the operation, as illustrated by the table drawn up by Sir Frederick Treves, are no longer operative. Consequently, with proper care in the selection of cases, added to modern technique, the operation undertaken in the quiescent stage should be completely successful.

Recurrence after an Abscess.—I now turn to those cases of appendix abscess in which the pus is evacuated but the appendix is not removed. In 1905, at the discussion before the Royal Medico-Chirurgical Society, the general feeling was that if a patient had an appendix abscess, his chances of having a further attack were very slight; and it was even said that if a concretion was found in the pus, there would be no further attacks. Credit must be given to Battle for so vigorously advocating removal of the appendix in all cases of abscess; if it could not be done easily at the time the abscess was drained, he advised an operation during the quiescent stage.

At the present time it is the usual practice, when operating upon an abscess, to remove the appendix unless there is great difficulty in doing so; but at one time it was the rule to be content with opening the abscess, and not to remove the appendix unless it actually presented itself during the operation.

From the statistics which were brought forward at the above meeting, I have been able to collect the following cases in which an abscess formed and was evacuated without the appendix being removed, and in which the question of further attacks was investigated. From St. George's Hospital there were 15 cases; 2 of them had further attacks, after which the appendix was removed. Pearce Gould brought forward 71 cases: 41 occurred in his hospital and 30 in his private practice; 4 of the former and 1 of the latter had subsequent attacks of appendicitis for which the appendix was removed. Battle operated on 54 cases of appendix abscess which recovered, and no less than 12 had further symptoms necessitating appendicectomy. Together this gives a total number of 140 cases, 19 of which—that is, about 13.5 per cent—had further attacks.

For the same meeting, I wrote to and had replies from 133 patients who had had an

* Lett, "The Present Position of Appendicitis", *Lancet*, 1914, i, 295.

abscess or general peritonitis in whom the appendix had not been removed; 21 of them said that they had had further attacks, a proportion of 14·6 per cent. Taken by themselves, these replies would not be of much value, unsupported as they are by medical evidence; but the result coincides so closely with that found in the above 140 patients, 13·5 per cent of whom had so much trouble with the appendix after the abscess had been drained that a further operation was necessary, that their insertion here is justified.

Hoffmann reported that out of 78 cases of appendix abscess, 44 had trouble subsequently in the form of abdominal disturbance or pain, and that in a certain proportion there were further definite attacks of appendicitis.

An interesting paper was published by Dodds Parker in 1912. He recorded 17 cases of appendicitis with abscess formation in which the appendix was removed when the attack had subsided. In none of these cases was the appendix destroyed or its lumen obliterated, but in all of them there were adhesions, kinks, and scars, which of course predisposed to further attacks.

SEX AND AGE.

Sex.—It has long been recognized that the male sex is more liable to attacks of appendicitis than the female, and numerous statistics have been published to illustrate the incidence of appendicitis in the two sexes. In the 1905 series, I found that of the 1000 cases, 682 were males and 318 females, the males forming 68·2 per cent of the total. Of the 898 cases which were operated upon in the London Hospital in 1912, 515 were males and 383 females, a percentage of 57·3. Added together, in 1898 cases there were 1197 males, that is, 63·1 per cent. This agrees closely with the results obtained by MacCarty, who compiled 2586 cases reported by four different writers, of which 64·7 per cent were males.

In order to obtain still larger numbers, I collected all the cases admitted to the London Hospital during the years 1901–12. I found that there were 3652 males and 2426 females, a total of 6078. This means that the male patients formed almost exactly 60 per cent of the cases, and coincides remarkably with Kelly's investigations, for he found that in the Johns Hopkins Hospital the proportion of men to women was as 60 to 40.

The preponderance of the male sex is not limited to adults only; the same holds good in the case of children. In 1912, 99 children were admitted to the London Hospital suffering from appendicitis; 61 were boys and 38 girls, a male percentage of 61·6.

Why the male sex should be more subject to appendicitis than the female is not known, though numerous explanations have been offered, ranging from an alleged additional blood-supply in the female sex through a branch of the ovarian artery, to a greater exposure to injury and the excessive use of tobacco in the male sex.

As to the severity of the attack, although men are more frequently subject to appendicitis, the attacks appear to be more serious in the female sex, and are attended by a higher mortality; for example, of the 515 men, 14 died; of the 383 women, 16 died: a male mortality of 2·7 per cent, while the female mortality was 4·2 per cent. This suggests that although males are more frequently affected, roughly in the proportion of 6 to 4, the attacks are more serious and more fatal in the female sex.

Age.—The age at which appendicitis occurs varies within wide limits, although, as we shall see presently, there is a very definite period of life when the disease is especially common. In the present series the youngest patient was 10 months old, and the oldest 72 years; both recovered. The oldest patient, however, that I know of, was a gentleman of 84 upon whom I operated and from whom I removed a gangrenous appendix. He made an uninterrupted recovery. On referring to *Table F*, it will be seen that of 1000 cases, 117 occurred in children up to the age of ten, 339 between eleven and twenty, and 275 between twenty-one and thirty—that is, 614, or 61·4 per cent, occurred between the ages of eleven and thirty, and 731, or 73·1 per cent, before the age of thirty-one.

As regards mortality: it has long been said that the mortality is especially great in the earlier and later periods of life, and it is interesting to see that the results obtained in the present series bear this out. Among 117 cases under eleven years of age there were 7 deaths, a mortality of 6 per cent. Between eleven and twenty there were 339 cases, with 9 deaths, a mortality of 2·7 per cent, and between twenty-one and thirty,

275 with 10 deaths, a mortality of 3·6 per cent. We next come to the period between thirty and fifty; here the results are very remarkable, as in 233 cases there were only 3 deaths, giving the low mortality of 1·3 per cent. It is always dangerous to draw conclusions from statistics unless the figures are very large and all causes of error have been excluded as far as possible; still, one cannot help feeling it is very suggestive that out of 233 cases there should only be a mortality of 1·3 per cent.

Table F.—MORTALITY OF APPENDICITIS AT DIFFERENT AGES.

Age	Quiescent		Inflamed		Local Peritonitis		Abscess		General Peritonitis		Total		Mortality per cent
	R.	D.	R.	D.	R.	D.	R.	D.	R.	D.	R.	D.	
0—10	12	0	40	0	13	3	33	0	12	4	110	7	6
11—20	78	1	107	1	55	0	59	2	31	5	330	9	2·7
21—30	103	0	76	0	27	2	51	4	8	4	265	10	3·6
31—40	66	1	42	0	15	0	29	0	7	0	159	1	0·6
41—50	28	0	14	0	5	0	21	1	3	1	71	2	2·7
Over 50	13	0	4	0	2	1	11	0	3	2	33	3	8·3
Total	300	2	283	1	117	6	204	7	64	16	968	32	3·2

R = Recovered. D = Died.

Over the age of fifty, the numbers are so small as to be of little value. There were 36 patients, 3 of whom died, giving a mortality of 8·3 per cent. One is not surprised to find that the mortality in people of advanced years is greater than that in young people and those in the prime of life. It only stands to reason that a patient who is getting on in years, and is possibly troubled with some deficiency in the pulmonary, cardiac, or renal organs, should be more likely to fail to respond to treatment, and should succumb from heart failure or pulmonary complications.

CHRONIC APPENDICITIS.

So far I have dealt only with the prognosis in acute cases. Chronic appendicitis must also be considered, not only in relation to the possibility of further acute attacks, but also in relation to other more remote effects. The so-called appendix dyspepsia is now a well-recognized clinical entity, and of late the medical profession has realized the frequency with which chronic inflammation of the appendix is associated with important pathological conditions in the upper abdomen.

Appendix Dyspepsia.—It is now generally recognized that chronic inflammation of the appendix may give rise to symptoms simulating ulcer of the stomach or duodenum, or gall-stones; and a definite diagnosis between these various conditions can be made in the great majority of the patients, if the case is properly investigated, and a full account of the symptoms obtained and thoughtfully considered. The writings of Paterson and Moynihan should be consulted, particularly the article by Moynihan in the *British Medical Journal*, January 29th, 1910, and the article on 'Appendix Gastralgia' in Paterson's book, *The Surgery of the Stomach*. I may, however, touch briefly on the principal features of this condition. The most frequent symptom is pain or discomfort in the epigastrium, coming on at a varying time after food, sometimes immediately, in other cases not until two hours or more have elapsed. It is frequently associated with distention and regurgitation. Unlike gall-stones, the character of the food makes little difference. An important point of differentiation between the dyspepsia due to the disease of the appendix, and other kinds, is that in the former the symptoms are practically continuous with very little variation, whereas in the latter the patients nearly always have intervals of weeks, or even months, in which they are comparatively free from pain. Occasionally, but in my experience it is rather exceptional, the pain is referred from the epigastrium to the right iliac fossa; tenderness in the right iliac fossa is occasionally met with, but may be entirely absent. Exercise such as cycling, and

particularly golf, is liable to bring on the pain, or, if present, to aggravate it. Moynihan has drawn attention to the fact that pressure on the appendix region may produce epigastric discomfort. Conversely, I have had a number of patients who complained of pain in the right iliac fossa when pressure was made upon the epigastrium. A somewhat alarming symptom, which is by no means uncommon, and which I have met with in a fair proportion of my cases, is hæmatemesis.

An interesting feature in these cases is the comparatively small number of patients who have had previous severe attacks of appendicitis, so that in many cases the patient has no reason to suppose that his appendix is at fault. Harold Barclay has drawn attention to this in an article in the *American Journal of Surgery*. In 41 cases he found only 5 with a direct history of previous attacks.

Sherren divides cases of appendix dyspepsia into two groups. In the first he places patients operated upon for intractable indigestion, in whom, after the upper abdominal organs had been explored, the appendix was removed. In this group there were no local symptoms or physical signs indicating disease of the appendix. In the second he places patients operated upon for attacks of abdominal pain diagnosable as due to the appendix, in whom there was a history of long-continued indigestion. The condition of these cases twelve months or more after operation was as follows. In the first group, out of 52 cases 36 were absolutely well, 6 were almost well and complained only of a little flatulence at times, 2 were 'better', and in 8 there was no improvement. In the second group, out of 42 cases, 36 were cured, 3 much improved, and in 3 there was no improvement.

Gastric and Duodenal Ulcer.—It would appear that appendix dyspepsia is a preliminary stage only, and if it is neglected, gastric or duodenal ulcer may supervene. This is only reasonable when we consider that in many cases, on opening the abdomen, the pyloric portion of the stomach is seen to be in a condition of spasm (Moynihan); this causes delay in the emptying of the stomach and so predisposes to chronic catarrh. Then again, hæmatemesis is generally recognized as being by no means uncommon in appendix dyspepsia, and in one case Paterson observed multiple erosions of the mucous membrane of the stomach. That gastric and duodenal ulcers are associated with chronic disease of the appendix, cannot be denied. As long ago as 1908 Mohnert found that in 64 per cent of a series of gastric-ulcer cases there were inflammatory changes in the appendix. Paterson says that among his cases of duodenal ulcer extending over three years, there was obvious disease of the appendix in 66 per cent. Moynihan, taking a short series of 14 cases of duodenal ulcer, examined the appendix in 12, and in 80 per cent found evidence of long-standing disease in it. McCarty and McGrath report that in 52 operations for gastric and duodenal ulcer, 26.9 per cent of the appendices which were removed were partially or completely obliterated. In my own experience, it is the exception to find a normal appendix in the presence of a gastric or duodenal ulcer.

Gall-stones.—These, too, apparently come into relation with chronic appendicitis. In several cases where the symptoms have been those of chronic cholecystitis, I have found adhesions round the gall-bladder with some congestion of its mucous membrane, and a chronically diseased appendix. Here again, McCarty and McGrath have some very interesting statistics. In 57 autopsies on cases of cholecystitis, the appendix was partially or completely obliterated in 52 per cent. They further draw attention to the fact that of 365 cases of cholecystectomy, in 23.2 per cent the symptoms began at or under 25 years of age, a period when appendicitis is extremely common, and in 13 per cent there was a history of pain and soreness in the appendix region. The appendices were only removed in 59 of the above cases, but 69 per cent of these appendices showed undoubted signs of disease. They suggest that the sequence of events is, first, a chronic appendicitis; secondly, cholecystitis; and, finally, gall-stones.

It is now generally recognized that the appendix may play an important part in diseases of the upper abdomen, and that no operation for gastric or duodenal ulcer, cholecystitis, gall-stones, and possibly pancreatitis, is complete without examination of the appendix, and its removal if diseased.

The prognosis, therefore, for a patient who has had one attack of appendicitis is somewhat as follows: Over 50 per cent of patients have further attacks, and of these, 60 per cent have further attacks within twelve months, and 80 per cent within two years. There is also a possibility of appendix dyspepsia, gastric or duodenal ulcer, or

gall-stones supervening. It is not possible to give statistics to prove the frequency with which the latter complications arise. One can only say, in accordance with the statistics already referred to, that in probably 75 per cent of cases of gastric and duodenal ulcer the appendix is considerably diseased, and that in 175 cases of gall-stones and cholecystitis, McCarty and McGrath found its lumen obliterated partially or completely in nearly 50 per cent, and consequently we may assume that there was evidence of disease, less pronounced, in considerably more. In addition, we have to remember the numerous cases of appendix dyspepsia which have come to operation before these serious complications have supervened.

Colitis.—Lastly, there is a certain number of cases of colitis which are the direct result of chronic inflammation of the appendix. It may be taken as a general rule that appendicectomy is indicated provided the colitis was immediately preceded by a definite attack of appendicitis; under these circumstances the prospect of a cure of the colitis is good. This favours the theory that the diseased appendix is constantly discharging colonies of virulent bacteria into the cæcum which cause and keep up the colitis. If, on the other hand, the colitis appeared first and the appendicitis seems to be secondary to it, there is little prospect of curing the colitis by removing the appendix.

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Hugh Lett.

ARRHYTHMIAS.—(See PULSE, IRREGULARITIES OF.)

ARSENIC POISONING.—In the outlook of poisoning by arsenic, much depends on whether the poisoning is acute or chronic. In the former, the combination of violent purging with sanguineous stools, urgent vomiting, collapse, cyanosis, suppression of urine, convulsions, and coma, form a clinical grouping from which recovery is all but hopeless.

If the case is less acute, it is important to bear in mind the fact that remissions may arise in the symptoms, leading to false hopes, and that such patients not infrequently pass into a fatal relapse. If the patient recovers, convalescence is frequently tedious, and, later on, arsenical nervous phenomena may appear. The chronic form of poisoning may result from the continuous ingestion of the drug over long periods, or may follow a single large dose. The drug may, however, be taken in large quantities over

very prolonged periods, as among the natives of Styria, without harmful effects arising. Signs and symptoms of peripheral neuritis have arisen as long as two months after a single large dose. Women are said to be more susceptible to nervous phenomena than men, though in both sexes advancing age increases the liability to affection of the nervous system.

Children tolerate arsenic well. In chronic cases in which keratosis has appeared, it should be remembered that epithelial cancer sometimes develops. Apart from this, the skin lesions generally get well in time if the patient is removed from any further intake, although in some cases pigmentation may remain permanently.

There may be a susceptibility to the effects of arsenic in an individual, even in small doses. Thus severe symptoms of poisoning have followed one-tenth of a grain of chloride of arsenic. Death has occurred after intravenous or subcutaneous injections of $\cdot 3$ grm. of salvarsan. The symptoms, which give rise to great alarm after an injection of salvarsan or one of the allied compounds, include great anxiety and restlessness, cyanosis, asphyxia, pain at the back of the neck, suppression of urine, collapse, coma, and convulsions. Fatal jaundice may supervene, even after weeks have elapsed since the last administration of the drug. As a rule a person who has taken a fatal dose of arsenic dies in eighteen hours to three days, but in many cases death has occurred within four hours. A patient may, however, recover from the immediate effects of the arsenic and die from exhaustion some weeks later, no arsenic being found in the body.

The fatal dose of white arsenic is about 2 gr. A woman died who took half an ounce of Fowler's solution in five days.

J. R. Charles.

ARTERIAL TENSION, HIGH.—It is convenient to give some little consideration to this subject as apart from that of arteriosclerosis, but most of the facts relating to this syndrome will be found under the latter heading.

The pathological facts on which prognosis should be based are: (1) Renal disease accompanies three-quarters of all cases of high tension; (2) The tension cannot rise beyond a certain point without wearing out the circulatory tube, either at the cardiac or the peripheral end; (3) The risks are therefore those of uræmia, cardiac failure, and cerebral hæmorrhage. Janeway's analysis of 100 fatal cases of hypertension (170 mm. or over) showed that death was due more or less directly to cardiac failure in 36, to uræmia in a like number, and to cerebral hæmorrhage in 14. In de Havilland Hall's 20 cases, on the other hand, there were 7 cardiac, 7 apoplectic, and only 3 uræmic deaths.

The duration of life in Janeway's cases varied from four months to eleven years, and averaged a little less than four years. The particular kind of death did not have much bearing on the duration of life.

The conditions on which prognosis is founded in individual cases are three: (1) *The height of the pressure*; (2) *The cause or causes*; and (3) *The general symptoms*.

1. The Height of the Pressure.—The following facts illustrate the first point. Examination of a large series of insurance figures showed that the mortality in persons with a systolic pressure exceeding 150 mm. Hg was 35 per cent in excess of the average, while that in persons whose pressure was 170 or over was no less than four times as heavy as that of the average man. To quote de Havilland Hall again, he found that of a number of persons followed up for a definite period, the mortality rates worked out as follows:—

Tension	Mortality per cent
Below 120	5·7
120-140	3·5
141-160	3·0
161-180	26·3
181-200	41·6
Over 200	53

These figures suggest that pressures up to 160 in middle-aged people do not matter much, but that after that the prognosis grows rapidly worse as the figure rises.

In assessing the importance of the actual systolic pressure, there are several modifying circumstances to be taken into consideration. The normal rises with advancing years. A rough and ready way of remembering this is to add the patient's years to 100, the result being his normal pressure; thus, the pressure at the age of forty should be 140; this gives rather high results for the later decades, but otherwise it will serve. Again, sex makes a difference: the average tension is 10 or 20 mm. lower in a woman than in a man of the same age. In a nervous subject there is always a risk of getting too high a reading, and some instruments, such as the Pachon oscillometer, give artificially high results. Broadly, a rise of pressure in which both the maximal or systolic and the minimal or diastolic figures go up is worse than one in which the systolic rise is out of proportion to the diastolic. There are two reasons for this. First, the kind of case in which both figures rise is that in which the kidneys are likely to be profoundly diseased, while a rise in the systolic pressure alone is (in the absence of aortic valvular disease) likely to be due partly or wholly to various causes, often transient, which operate through the vasomotor nerves. Second, a rise which persists through diastole as well as through systole subjects the left ventricle to a greater strain and exhausts its reserves more rapidly. It must also be remembered that a definitely rising pressure is of graver import than a stationary one, and that we should particularly fear those crises of hypertension that are liable to arise in cases of granular kidney, often without apparent cause, for they bring into the case a special risk of cerebral hæmorrhage. Conversely, a fall in tension is anything but welcome when it is accompanied by threatenings of cardiac breakdown.

2. The Cause or Causes.—As to the importance of causes it must never be forgotten that in a majority of hyperpiesics the kidneys are the seat of progressive disease. The more obvious these renal lesions are to the clinician, the worse the outlook. In many cases it is advisable to estimate renal function by means of the urea-concentration test before making up one's mind as to the real significance of a high blood-pressure. If, however, there are contributory causes such as excess in tobacco or food, too much stress, and so on—factors that are in some degree susceptible of removal—the prognosis is a little alleviated; but it must be confessed that even when everything has been done that can be done, the high pressure tends still to persist and to rise relentlessly. There is a kind of high tension, glanced at above, which is seen in its most characteristic form in women at the climacteric. The systolic pressure rises out of proportion to the diastolic, so that the pulse-pressure is also increased. The causation is obscure, but it is probably due to psychical and endocrine factors operating through the vasomotor nerves. The outlook is better than in hyperpiesis accompanied by definite renal lesions, but it is not unreservedly good. Evidences of renal disease are apt to appear, and eventually the rise in pressure becomes permanent.

3. The General Symptoms.—There is no need to go fully into the symptoms, since the calamities that are to be anticipated—cardiac failure, uræmia, and cerebral hæmorrhage—are dealt with in appropriate articles. The only point that need be made here is that each of these catastrophes is often foreshadowed by events which may appear trifling in themselves, but which have a great significance when looked at as foreshadowing the final downfall. The cardiac symptoms that belong to this category are those that indicate failure of contractility: increasing breathlessness, periodic dyspnœa, swelling about the ankles, precordial pain on exertion, and the bruit de galop. The likelihood of an apoplectic seizure is also often hinted at, and not obscurely, by two sets of phenomena—hæmorrhages elsewhere (nose, retina) and cerebral symptoms (headache, vertigo, mental obfuscation, transient palsies, and so on). The transient palsies are of the gravest significance: temporary aphasia, hemianopia, strabismus, hemiplegia, and such like, are to be accepted as very direct forewarnings of danger in persons with a raised blood-pressure. Polyuria, early morning headache, and eye symptoms are, according to Janeway, precursors of uræmia.

The effects of treatment on high tension are disappointing. In favourable cases, dieting, purgation, and systematic moderate exercise, with restriction of mental stress, may keep the pressure from rising; but once high pressures of 180 mm. and over are reached, it is almost impossible to get them down again. Even the nitrites are often ineffectual. The experiments of Matthew and others demonstrated this very clearly. They further proved that the most useful of the nitrites for continued reduction of high

tension was erythrotetranitrate, but that, owing to the headache which this is apt to produce, it cannot often be used continuously. Under these circumstances sodium nitrite in frequently repeated doses will be the most useful vasodilator, and it may be possible to effect and to maintain a lowering of 10 or 20 mm. The fall in pressure produced by nitroglycerin and by nitrite of amyl is too fleeting to be of service for reduction of a persistently high pressure. Potassium iodide cannot be relied on to depress tension, and the effect of venesection is also very brief.

Carey F. Coombs

ARTERIES, WOUNDS OF.—(See HÆMATOMA, ARTERIAL.)

ARTERIOSCLEROSIS.

General Outlook.—This is a most difficult matter to write about in a case of arteriosclerosis. It is inevitable that, in this article, there should be some overlapping of others, that dealing with high blood-pressure in particular; so far as may be, however, my purpose is to indicate what is to be feared for a patient in whom the arteries are found to be sclerosed. Now the practitioner's attention is directed to this condition under two sets of circumstances. First, in the course of a general examination—for life insurance, for example—it is found that the radial artery is tortuous and hard, beaded it may be, the brachial artery unduly palpable, the abdominal aorta cordlike and throbbing; in a word, general arteriosclerosis is accidentally discovered. In the second type of case, the patient complains of cerebral, cardiac, or peripheral symptoms, and the physical examination reveals the source of these in a progressive arterial degeneration. In the first case, the disease is discovered at an early stage, before it has begun to produce tangible interferences with function; in the second, these interferences have already begun. In any case, chronic arterial disease threatens life and health in one way, by spoiling the nourishment of various organs and tissues; the three gross manifestations of this process are cerebral softening, cardiac failure, and senile gangrene. There is, of course, the risk of cerebral hæmorrhage to be considered; but this is so closely connected with high blood-pressure that it will only receive brief comment in this article.

In any given case there are three things to consider: (1) *The etiological factors*; (2) *The stage of development* to which the disease has attained; and (3) *Its distribution*.

1. Etiological Factors.—Confronted by arterial degeneration in a patient, we naturally want to know the reason; and two aspects of this question present themselves to the mind. Sooner or later, arterial degeneration is the common lot of man, provided he lives long enough; in other words, the tunica media of the arterial tube tends 'normally' towards decay after a certain age. It is said (Adami) that this downward process begins at about thirty-five; at this time the katabolic leanings of the cells of the arterial media begin to gain the upper hand. Now the rate of downward progress appears to depend on two sets of factors, the *congenital* and the *acquired*. Of these it is difficult to say which is cause and which effect; the writer inclines to the belief that arterial degeneration is always the outcome of toxic agencies acting on a tissue, the tunica media, whose vulnerability varies with certain inherited characteristics at present undefined. Of these toxic agencies, some, as we shall see, are perfectly obvious, others less so. It follows, therefore, that in estimating the prospects of arterial sclerosis in any given patient, we must take into consideration: first, the kind of arteries he inherits; second, the existence or non-existence of any toxæmias to which his arterial decay may be partly ascribed.

Congenital.—It is probable, though not proved, that a poorness of arterial make-up is inherent in certain families; that, in these, the medial cell is particularly open to malign influences. At all events, there are families whose members seem doomed to suffer early arterial degeneration without obvious cause.

Assessment of the familial factor is conducted along obvious lines; the age at death of the patient's forebears, their fitness for work during the decades when men commonly begin to wear out, the cause of death—all have to be passed under review. The kind of history to make a man repent his choice of ancestors is that in which generation after generation has decayed mentally at, or soon after, sixty, or in which a similar liability to cardiac breakdown has displayed itself. The family doctor often enjoys a great advantage here: he recollects how the father of the patient was an old man at fifty-five, and

assesses the prospects of the present generation accordingly. The first definite question to be answered in any given case, then, refers to the quality of blood-vessel which the patient inherits.

Acquired.—The acquired factors leading to arteriosclerosis are some of them obvious, while others are but dimly perceptible. Among the obvious ones are certain toxic substances, of which lead is the most conspicuous example. Some of the more obscure causes hang together in an indefinite kind of group: over-eating, excess in meat, mental or muscular stress, high arterial tension, renal disease.

We ought to consider next, then, whether any such cause is discernible; if so, whether it is operative at the time of examination or no; and whether, if operative, it can be brought to an end. It is easy enough to ask these questions, and just as difficult to answer them categorically. Take the most definite of all, lead; does it indeed act directly on the arterial media, or only through the renal lesions which it causes? Perhaps the way to approach this from the prognostic viewpoint may best be illustrated by examples of the two extremes. A young man with abnormally palpable arteries, but no evidence of renal disease, may look forward with confidence to the future if he be removed forthwith from the risk of further poisoning. On the other hand, a man of sixty, with pronounced arteriosclerosis and quite definite signs of renal lesion, cannot expect any great improvement in his outlook, even though he leave his injurious work forthwith. This is tantamount to saying that the prognosis in a case of plumbism depends not merely on arterial, but also on other, lesions; but that so far as the arterial changes are concerned, the fact that the cause is one whose further operation can be prevented is all in favour of the patient.

Of other definite chemical substances known or thought to act deleteriously on the arterial media, two of the luxuries of life come instantly to the mind, alcohol and tobacco. There is, at the present time, a tendency to belittle the part played by alcohol in the processes of arterial disease; none the less, it is fair to console the arteriosclerotic patient, whose alcoholic excesses have been noteworthy, with the assurance that abstinence will be good for his arteries; yet it is probable that the effect on the outlook is not great. As for tobacco, it is very difficult to see daylight here. On the one hand, we have the well-known effect of nicotine on the arterial walls—a fact which Josué and others have used experimentally to such good purpose—backed up by many clinical experiences of coincidence between arterial disease and excess in tobacco; on the other hand, there must be reckoned statements like those of Herz, of Vienna, who made a collective inquiry into the etiology of arteriosclerosis in Austria, and found that the disease was not particularly common, even in districts where the women smoke pipes and the habit begins in childhood. It is, at any rate, permissible to forecast a good effect from cessation or moderation of smoking, where this has been excessive and no other factor is definitely discernible. The same may be said of tea-drinking in excess.

Passing from these poisons, we come to those of definite bacterial origin. Among these, typhoid fever stands out prominently. Councilman's researches showed that the arteries of persons who have had this disease are thicker than those of persons who have not. In syphilis, again, a similar change may be observed, quite apart from the local arteritis which is provoked by this infection. If, therefore, we find evidences of early arterial degeneration in a comparatively young subject who has had typhoid fever, their significance, so far as length of life is concerned, is probably slight; that which caused them is no longer operative (always supposing there is no reason to believe the infection to be persistent). In the case of the syphilitic, on the other hand, the outlook is less reassuring, for it is not easy to be sure that the infection is no longer active. If the patient underwent thorough treatment, and if the Wassermann reaction be negative, it is probable that syphilis is no longer operative as a cause of arteriosclerosis, the prognosis being good so far as this factor is concerned. Of the other infections we know less, and they do not enter into the assessment of expectation of life in arteriosclerosis.

Yet another group of toxic agencies has to be considered, those of endogenous origin. Certain of these, which are relatively definite, may be considered first. Arterial disease is associated with glycosuria, and here the cause overshadows the effect, so far as prognosis is concerned; we do not estimate the chances of our glycosuric patient in terms of his arteries, but in terms of his output of sugar and the degree to which this can be

controlled. It may, however, be remarked that the progress of arterial change in such persons is relatively slow, and that the outlook is therefore better than in some types of arterial degeneration. Mitchell Bruce found that cardiovascular degeneration in glycosuria ran an average course of over twelve years from the onset of symptoms. That gout plays a part in causing arteriosclerosis is also clearly proved. If, therefore, an arteriosclerotic patient be definitely gouty, and other causal factors are not apparent, the prognosis varies according to the amenability of the parent disorder; should the gout yield to dietetic and other measures, the arterial changes will progress but slowly. These are well-defined morbid entities; but they merge insensibly into other categories which are not so easy to understand—those of renal disease, mental and muscular stress, over-eating, and hypertension. So far as this article is concerned, the last of these may be dismissed in a word or two; high tension is not a disease, but a symptom arising from a variety of causes, and when it coincides with arteriosclerosis it is probable that the two constitute different aspects, the one anatomical and the other physiological, of one and the same process. In any event, it is more convenient to consider such cases under the caption of high tension, as I have done in the articles in this book. Arteriosclerosis as complicating renal disease will also be considered under the same heading. It is not quite proper, however, to dismiss all the factors named above in this way; for though arteriosclerosis is seldom provoked by over-eating or stress, apart from high tension, yet this latter may be relatively slight, and the arterial change comparatively prominent. Excess in food is an extremely common and important cause of arterial degeneration; this is often apparent in persons who eat large masses of food in general, and red meat in particular. There is no factor which can be cut out with greater confidence of bringing about improvement in the patient's condition; consequently, the arteriosclerotic person who over-eats, and yet consents to a genuine correction of his evil ways, stands a far better chance than one who is incorrigible. As to stress, it is pretty clear that it is mental and not physical overstrain that tells; indeed, as French has suggested, much of the premature arterial decay of city men is to be referred to over-work of some arteries (cerebral and alimentary), in contrast with under-work of those supplying the skeletal muscles; and if such persons can be persuaded to work and eat less, and to take regular physical exercise, the prognosis is thereby ameliorated. Finally, it is possible to analyze the stress factor a little further, for Mitchell Bruce distinguishes between emotional and intellectual expenditure, and finds that it is the former that is especially hard on the arteries. Now this brings us to the furthest point to which it is legitimate to press the toxic analogy; it is probable that over-eating causes arteriosclerosis through the agency of toxins, and it is possible that stress, even of the emotions, acts in the same way, but it is also very certain that emotional strain is a matter of temperament. Here we come to the fact that there are cases of arteriosclerosis in which it is possible to tell the patient that it is folly to continue to live as he is living—over-eating, under-exercised, constantly devoured by anxiety and excitement—and to say that if these causes be removed his life will be prolonged, and arterial decay slowed down: and yet the patient may be so constituted temperamentally that he simply cannot stop. Unless such people learn a philosophy which excludes worry, early in life, it will be impossible to help them much. Hence, temperament is an important etiological factor in the prognosis of arteriosclerosis; it is a potent cause, and yet, at the same time, one which is as difficult to combat as it is for the Ethiopian to change his skin. In people of the worrying, anxious kind, therefore, arteriosclerotic changes are less easily checked, and, on that account, of graver import than in persons who take life quietly, and who will readily consent to profound alterations in their manner of living.

Summing up what has been said as to the importance of etiology in prognosis, we find that arteriosclerosis is more likely to run a favourable course if it is largely dependent on some causal factor which can be removed.

2. Stage of Development.—A second factor of importance, in arriving at a forecast of the future awaiting the arteriosclerotic person, is the stage at which it is first found that the vessels are not normal. It is tempting to divide the progress of arteriosclerosis into chapters, but this is of no value so far as our present purpose is concerned; and the importance of the epoch at which the arteriosclerotic patient comes under observation is best realized by contrasting the outlook at the two extremes of the malady. Ignoring

for the present the presclerotic stage of Huchard, which is best considered under the caption of high blood-pressure, we find that the earliest stage of arteriosclerosis to come under notice is that in which thickening of the vessels is encountered accidentally, in persons who present themselves for examination on account of other symptoms or reasons. In such cases there are no subjective evidences of arterial disease, or, at least, none that have struck the patient as noteworthy. Now, it would be rash in the extreme to offer a prognosis in such cases; as a rule none is asked for, and even when it is, it is seldom that one can give an opinion that is of much value. In extreme cases the gravity of the outlook is easily perceived: e.g., in a patient of forty who has arteries thicker than most men of sixty, and whose forebears have died young. Here the prognosis is clearly bad enough to justify a statement to that effect, if the physician thinks any good can be done by it; if any contributory cause can be traced, such as excess in meat, it may, indeed, have a salutary effect on the patient if the prospects be hinted at, together with the amelioration that is likely to accrue from a reform of the diet. But in the majority of such cases, if we are asked for an opinion as to the patient's future by himself or his friends, and we have no evidences of arteriosclerosis apart from what can be felt with the finger, it is possible only to say frankly that the vessels are thicker than they ought to be; that this is by no means a certain sign of curtailment of the expectation of life; and that reasonable living is even more necessary than in the average individual, since this alone can avert such menace as is implied in the existence of arterial change. Sometimes it is possible to form a rather more accurate opinion of the patient's chances by seeing him several times, at fairly long intervals, e.g., six months; if such systematic observations enable one to detect the beginnings of visceral change, as a result of the arterial lesion, the task of prognosis is clarified.

At the other extreme of the sclerotic process, the patient comes under observation suffering from the organic effects of the disease. Of these effects, three stand out pre-eminent: cardiac failure, softening of the brain, and peripheral gangrene. Each of these will be considered under its appropriate heading, so that we need not regard them in detail, or from any point of view other than that of arteriosclerotic phenomena. From this standpoint, their importance is that they prove the disease to have reached an extreme stage—so extreme, that the vessels no longer perform their function of supplying nourishment to the organs dependent on them. Now the principle running through the whole prognosis of arteriosclerosis is its incurability; the disease may be retarded, possibly arrested, but it is impossible to put the clock back. It follows, then, that these phenomena are evidences of the final development of incurable arterial disease; and the prognosis, so far, at all events, as the injured parts are concerned, is unreservedly bad.

Between these two extremes there are all shades of cases in which there are symptoms referable to arterial disease. From the prognostic standpoint, these are chiefly of importance in so far as they prove that the disease has reached a stage at which it interferes with the nutrition of the parts supplied. Some of these phenomena are of special interest, and may therefore be considered in detail. The simplest to understand is transient dyskinesia of the limbs. The most familiar form of this is seen in the lower limb—an intermittent limp; the legs are comfortable while at rest, and able to carry their owner for short distances, but after a walk of varying distance cramps come on, and the limb suddenly gives way, sometimes so suddenly that the patient falls to the ground. Similar troubles may afflict the arm, rendering it painful and useless when it is put to the performance of unusual tasks. Such phenomena are, perhaps, most clearly seen in obliterative arteritis, but they do also occur in connection with ordinary arteriosclerosis. Their significance lies in the unmistakable evidence which they afford that the arterial disease has reached an advanced stage, and that absolute occlusion is not far off. Attacks which are probably similar in origin are seen in connection with the brain; such are transient hemianopia, squint, aphasia, amnesia, and even hemiplegia. These are to be regarded as evidences of advanced arterial disease, and as premonitions of permanent injury to the substance of the brain. The same may be said of angina pectoris, and the less definite grades of cardiac pain; the coronary channels are becoming inadequate to their duty of supplying blood to the myocardium. Attacks of abdominal pain, with meteorism, have been described as 'abdominal angina', and referred to disease of the mesenteric vessels. All these paroxysmal phenomena are therefore of the gravest import,

for they bespeak a stage of arterial disease which can scarcely go further without permanently cutting off the blood from the parts which the arteries supply.

Apart from such attacks, however, there are less striking symptoms which, none the less surely, portend advance in the arteriosclerotic process to the point at which adequate blood-supply is threatened. Such are vertigo, stumbling speech, slowed cerebration, persistent headache, and sleeplessness; breathlessness on exertion, puffiness of the ankles, and muffling of the cardiac sounds; impairment of sensation in the periphery of the limbs, and increasing muscular weakness. All these are to be interpreted as signs of progressive arterial degeneration when they are associated with palpable thickening of the surface arteries; and, as such, they add to the gravity of the prognosis, for they show that the disease is becoming effective as a hindrance to the proper nutrition of the organs and tissues of the body.

Summing up what has been said as to the significance of the stage of the disease in regard to prognosis, we find that arteriosclerosis tends to progress towards the point at which it cuts off blood-supply from certain parts of the body; and that we must be on the look-out for evidences of the earlier phases of this interference with nutrition.

3. Distribution.—One other aspect of the disease must be taken into account in working out the prognosis of any given case, namely, the distribution of the arterial changes. It is obvious that these are of much greater significance when they attack the vessels responsible for nourishing a vital organ, such as the brain, than when it is the leg that is threatened. Arteriosclerotic lesions of the brain are more hopeless in regard to recovery than any others; even in the most favourable cases of cerebral thrombosis of the senile type, the patient is never quite the same again, and usually his downfall is progressive and resistless. The cardiac lesions are less hopeless, perhaps, but more dangerous to life. Distinct evidences of abdominal arteriosclerosis are rare at any stage, and the data on which to base a general statement are, therefore, scanty; but it can be safely said that such phenomena as do point to this form of the disease are only very rarely followed by grave consequences, such as mesenteric thrombosis.

A last remark is this: that a calamity due to arterial degeneration in one part of the body predisposes to the occurrence of others. The most conspicuous example of this association is seen in the cerebral symptoms which are apt to follow close on cardiac breakdown due to arterial disease. Rest in bed pulls the heart through, but the brain remains injured.

Summary.—In any individual case of arteriosclerosis, the factors to be considered are: (1) The patient's arterial heritage; (2) The presence of toxic or stress causes, and the possibility of their removal; (3) The stage of the disease; (4) Its distribution.

Carey F. Coombs.

ARTHRITIS DEFORMANS.—We shall consider separately the prognosis of (I) *Rheumatoid arthritis*; (II) *Osteo-arthritis*.

I. RHEUMATOID ARTHRITIS.

The prognosis of rheumatoid arthritis must be made at present on broad and general lines, for we have to realize that a considerable change in the attitude toward the nature of the condition has taken place in recent years. There is a general feeling that some infective process is the exciting cause of the condition, or, what is probably more correct, that a variety of infective processes are concerned. The tendency now is to lay much emphasis upon the infection; and, from the point of view of investigation, this attitude seems to offer the best chance of making advance. Nevertheless, when we come to consider prognosis, we must admit that in many cases no causal infection has been demonstrated, and must further bear in mind that the individual constitution—whatever the nature of the rheumatoid arthritis may be—has probably an important bearing upon the course of the illness. It would be, then, a mistake to lose sight of possible fallacies in the present state of our knowledge. Thus, for example, a patient may be suffering from some degree of pyorrhœa alveolaris, but it does not necessarily follow that this is the determining cause of an associated rheumatoid arthritis. The writer's experience must be that of many others in finding that a patient has had clear evidence of rheumatoid arthritis at a time when the teeth and gums were in excellent order, and yet some years later,

with failure of health, both teeth and gums have become diseased, and the rheumatoid arthritis is still in evidence.

In other cases, unhealthy conditions have been corrected, but no obvious change in the course of the disease has followed. He would be the first to allow that the primary step in the study of such a case is a search for some local focus of infection, but is not prepared yet to admit that its discovery has necessarily solved the problem of the origin of the disease. Although encouraged by such a discovery to hope that a means of diminishing the severity, or even of arresting the course, of the disease had been found, he could not confidently assure his patient, on the evidence at present available, that such a happy event would follow.

Then, again, we must admit that in a considerable number of cases we can find no focus. This is certainly no proof that the condition is not infective, for, when all is said, the demonstration of an obvious local focus, though of the greatest importance, is an example of a somewhat crude method of infection. We do not always find gross local foci in cases of tuberculosis, or of pneumococcal infection, or of the rheumatic; for these infections may gain access to the system without a great parade at their site of entrance.

Dr. James Lindsay's statistics upon this question of infective foci are of interest.

In 138 cases in females :—

No focus was found in	-	-	65
Vaginal discharge in	-	-	36
Pyorrhœa alveolaris	-	-	19
Otorrhœa	-	-	7
Gastric ulceration	-	-	5
After childbirth	-	-	4
Rhinorrhœa	-	-	1
Chronic tonsillitis	-	-	1

Thus, in almost 50 per cent of these cases, no infective focus was forthcoming.

The prognosis, then, must clearly be based on broad lines, to some of which consideration will now be given.

Predisposing Causes.—1. *The family history* is doubtless of some importance, for we cannot but believe that the occurrence of the disease in several generations and members of the same family points to a weakened resistance to the infection, if there be one, or to some mysterious metabolic perversion if the fault should lie there.

2. The question of *age incidence* introduces the usual difficulty of deciding what is to be called rheumatoid arthritis, upon which there is no agreement at present possible; but we find that the disease in early life is likely to be more virulent, whereas in more advanced life, the natural tendency to degenerative lesions in the joints favours chronicity and crippling.

3. *Sex.*—The liability to rheumatoid arthritis in females is undoubtedly greater than in males; but when it occurs in the male it may be equally severe.

4. *The mode of onset* is of some importance. There is a group of cases in which rheumatoid arthritis begins acutely and affects many joints, producing rapid destruction. Among these cases, often called acute rheumatoid arthritis, are some of the worst examples of the disease. These are easily recognized by the fever, general toxæmia, and extensive and severe lesions. On the other hand, when they are less severe, although there may be much damage, the eventual recovery may be fair, and no second attack need necessarily occur. In any case, the illness will certainly be long and recovery slow.

5. Another very important group begins with acute symptoms affecting a few joints, or possibly only one. The onset is to this extent acute, but the general illness slight. In this group the cause is often obscure, and the tendency to further attacks very decided. The most experienced may make grievous mistakes in prognosis here, because there is at present nothing certain to guide the opinion. The first attack was mysterious, and the cause equally so. Accordingly, we find such patients coming to us a year or two later much crippled, and complaining that they were told at the time of their first attack that if they did so and so, and underwent such and such a course of treatment, they would be cured in six months. The essential point to remember is that when an arthritis of mysterious origin occurs and shows a tendency to be recurrent, the prognosis must always be tinged with caution. In another group the onset is even more gradual, with mysterious

pains and vasomotor changes; and these may prove to be most intractable, and end in complete disablement. Once again, the unknown factors in the disease baffle accurate prognosis.

6. *Occupation*.—It is probable that occupation is of very considerable importance in prognosis. The writer has been struck by the great severity of the disease in school teachers. The nerve-wearing life of the elementary schools; the effort to be of rather more importance than one can afford to be; and the struggle to get the necessary qualifications to reach this position, seem to combine in undermining the resistance to this disease in the most deadly fashion.

Again, there can be no doubt that long and anxious nursing of a near relative, or any other continual nerve-strain, may antedate a most serious rheumatoid arthritis, or greatly aggravate the course of the disease if it has already commenced.

7. *Surroundings* are also important. There seems no doubt that cold damp houses, a low-lying swampy country, and a heavy clay soil foster the chronicity of this disease. A favourite garden may do much harm to a delicate patient who is threatened with rheumatoid arthritis. Damp, changeable climates, such as our own, are generally agreed upon as favouring the disease.

8. *Diet*.—According to Pemberton, in rheumatoid arthritis there is a special metabolic intolerance to carbohydrates, and in less degree to proteins.

It is clear, therefore, that in making a prognosis we must take a broad survey of the general position, as well as pay close attention to the special points in the particular case. Bearing in mind, then, these general indications, we come next to the prognosis in the particular case, and find that this is a complicated problem. The danger to life in general terms, and with rare exceptions, is indirect rather than direct; the joy of living is destroyed far more often than life itself. There are, nevertheless, two important points in the prognosis: one concerned with the general constitutional disturbance, the other with the local arthritic lesions.

Cases in which profound toxæmia is evident in the sallow pallor, general depression, bouts of fever, loss of strength, tachycardia, and vasomotor changes, are among the most serious. In such, multiple arthritic lesions, sometimes of great extent, are coupled with profound muscular wasting. In such, too, grave signs of organic lesions of the spinal cord occasionally develop. In every direction treatment is embarrassed by the loss of strength and hope, by the distress on movement, and by the spontaneous neuritic pains. Among them are some of the most terrible examples of human suffering that are known in the field of medicine.

A paper by Nathan (*Amer. Jour. Med. Sci.*, Nov., 1916) appears to the writer to afford some suggestive information for guidance in prognosis. He produced an experimental polyarthritis in animals, and on examination of the vertebral columns found foci of endosteal and periosteal inflammation which had produced epidural and perispinal exudations. These lesions necessarily caused pressure upon, and irritation of, the nerve-roots. He pointed out that the neuralgic pains, muscular wasting, and vasomotor changes present in many severe cases of rheumatoid arthritis could not be explained as reflex results from the arthritic changes—an opinion with which the writer is in full accord. Arguing from his experiments, he attributed these phenomena to lesions in the vertebral column in man comparable to those in animals, and held that the prognosis in cases with well-developed and continued radicular irritation was bad. It is clear, if the phenomena are the results of such lesions, that the irritation to nerve-roots must be persistent unless the inflammatory foci disappear.

On the other hand, if the cachexia yields to treatment, and the arthritic lesions are not too far advanced, we know that in young subjects after a prolonged illness sometimes remarkable recovery may occur. Joints which only show active peri-articular lesions are not beyond hope, but it is when the atrophic shrivelling of the tissues supervenes that we realize that recovery of the affected parts is not possible.

The less virulent but mysteriously relapsing cases are of most uncertain prognosis, and number among them many courageous but hopelessly crippled patients, who live for years fighting against increasing disability. Yet we see in this group many cases in which the relapses cease as mysteriously as they appeared, and then there may be fair recovery, with a greater or less degree of infirmity, when hope has been almost abandoned.

II. OSTEO-ARTHRITIS.

The entity of this condition apart from rheumatoid arthritis has been the subject of considerable divergence of opinion. Eminent authorities have dwelt upon these distinguishing features: the character of the lesions, the lesser degree of muscular atrophy, the absence of muscular contracture and severe constitutional symptoms. Such differences cannot be explained by the age incidence, for osteo-arthritis may occur in childhood. A. E. Garrod has analyzed 100 of these cases, and points out that while rheumatoid arthritis is most frequent between the ages of twenty and forty, osteo-arthritis occurs most often between forty and sixty. In this series 83 per cent were females.

The prognosis unfortunately is very uncertain, for there are, as in rheumatoid arthritis, elements in the causation which we are not able to explain. We are not confident as to the extent to which infection takes a part, or clear as to the nature of such infection or infections. Again, we are not clear as to the part taken by the metabolic processes of the individual. So far as one dares to hazard an opinion in such a difficult problem, the writer inclines to the belief that disordered metabolic processes are of more importance in osteo-arthritis than in rheumatoid arthritis.

Such lesions as Heberden's nodes may remain the sole manifestation, and save for their unsightliness they are of little importance. Osteo-arthritis of the knee-joints, so common in women about the menopause, frequently quiets down under treatment, and though a menace to the stability of these joints, may run a favourable course. Unfortunately in some cases the disease breaks out in other important joints, and we find, for no obvious reason, our first more cheerful prognosis completely upset. We are, however, justified in urging that no step should be omitted for combating the disease, for it is by persistent efforts that the most favourable results have been obtained. Even if we believe that remedies have no specific action, all efforts to maintain the general health and to control obesity must be helpful. So, too, must be efforts to maintain the nutrition of the muscles, to spare the joints in acute exacerbations, and to encourage them in periods of quiescence. We cannot pretend to remove bony outgrowths or restore ulcerated cartilage by medicines.

On the other hand, the prognosis may be made more serious if ignorant attempts are made to 'work' the joints. Passive movements need the greatest judgement, for no one can calculate the amount of disease that may be present in such important structures as the crucial ligaments of the knee-joints. Again, courageous patients may, by ill-advised persistence in active movements when the arthritis is acute, cause themselves great suffering, and fan the flame of the disease.

Osteo-arthritis of the hip-joint is generally recognized as most recalcitrant to treatment. This form is commoner in males than in females. In these cases the elements of injury and overstrain are more apparent; but we must also remember that experiment has shown that intravenous injection of the diplococcus of rheumatism has produced this solitary lesion in animals. Ritchie attaches special importance to strain upon the joint when at its utmost limit of action, and suggests the probability of small hæmorrhages. Llewellyn is of opinion—and this is a point of much prognostic importance—that there is a preliminary period of villous arthritis. If this is the case, a great distinction between rheumatoid arthritis and osteo-arthritis is broken down, for the changes must commence in the synovial membrane, and not in the bone and cartilage; further, if the disease can be attacked in this early stage, and due rest be given to the joint before the bony lesions commence, the prognosis must be much improved. When the disease is fully developed, difficulties in treatment are apparent. The inaccessibility of the joint, the gross lesions, the influence of the weight of the body bearing on the altered surfaces of the articulation, and the mysterious lack of resistance in the affected tissues, are among the most apparent of these. Fortunately Nature sometimes comes to the rescue, and by fixing the joint and thus entirely destroying its function, puts an end to the advance of the disease, leaving the patient in comfort with a weakened limb. In carefully chosen cases, cheilotomy, as Sampson Handley has demonstrated, may produce an excellent result.

A short space may be devoted to a condition in childhood looked upon by many as a form of rheumatoid arthritis, but first clearly defined by G. F. Still. It is a multiple peri-articular arthritis with enlargement of the spleen and lymphatic glands. The condition

is a very striking one, and the recurrent attacks of fever are most suggestive of the presence of an infection. The writer more than once has seen such a case improve in the most remarkable way while under careful supervision, and then, without any discoverable reason, drift back to the last stage of emaciation and illness while in precisely similar surroundings. The prognosis of the characteristic cases is very serious; great crippling results, and death may occur. In some of the fatal cases, general pericardial adhesion has been found, the result of a pericarditis unsuspected during life. No treatment appears certainly to influence their course, although liquid paraffin and other intestinal disinfectants seemed for a while to do good in a few cases.

There appear to be transitional cases of less severity, some of them approaching closely the character of subacute rheumatism, and these may improve after several years, and eventually make a good recovery. Some of them seem to the writer to be associated with damp, low-lying districts, and the correction of this danger favours the outlook. The first steps that he would insist upon in any case of this kind would be removal from damp surroundings, and attention to the teeth and any nasal or other discharge.

THE INFLUENCE OF TREATMENT UPON ARTHRITIS DEFORMANS.

This is a question of much importance, and there can be little doubt that the great emphasis that at the present time is laid upon the infective element in the condition must eventually lead to much clearer views upon the value of numerous methods now in use.

If the condition is infective, there are two main indications for treatment: one to attack the infection, the other to promote the constitutional resistance. The first aims at destroying the focus of infection and counteracting the morbid effects already at work. It is clear from the pathology of the disease that many of the changes are inflammatory in nature, and run through the usual phases of such changes. There is the period of activity and the period of retrogression, and that of more or less perfect healing. Unfortunately, in many cases we do not know the nature of the infection, and the prognosis is the more serious on this account. It is rational to remove possible foci and to give proper rest to the tissues while the infection is active. It is also rational to treat cases with vaccines if the nature of the infection is known, and this method is really one of undoubted efficacy; but seeing that vaccines are often used without a conviction of the nature of the infection, and only on the hypothesis that some focus which has been singled out contained the real agent, the prognosis in many cases is not certainly improved; and more accurate details are still needed before we can estimate the improvement in the outlook resulting from such methods. The evidence of reliable data is urgently required. If the infection is thought to be located in the large bowel, then high douches are rational; but here again there seems good reason to think that the intestinal symptoms are frequently not the primary focus, but are a part of the general disorder, and so again the prognosis from this point of view remains uncertain until we can get more reliable data.

There are numerous methods of treatment directed to the damaged joints. It cannot be too much insisted that if the disorder is infective these methods do not deal with the cause of the disease. When Nature is conquering the local infections, then these measures, properly applied, favour the rapidity and completeness of recovery; but it is difficult to see how radiant heat, or massage, or Aix or Vichy douches, or peat or fango baths, can do more than assist a process of recovery—and to this extent improve the prognosis. Whether kataphoresis has real power in directly attacking local foci of infection must still be regarded as uncertain.

When we turn to internal remedies, we see once more that some are used to attack the supposed site of infection, as, for example, guaiacol carbonate and other intestinal disinfectants, while others are used to strengthen or alter the patient's general condition. Among these latter remedies we find alteratives, including mineral waters, and tonics, such as iron and arsenic, quinine, etc.

In such diverse conditions as those we are considering, it is eminently possible that in some cases of osteo-arthritis, internal treatment by drugs or by waters may be helpful, for in these metabolism seems certainly at fault; on the other hand, where the infection seems predominant, it is difficult to see how water-drinking will help, unless the minute traces of radium are to be looked upon as antibacterial. Radium water has come into prominence in the last few years, and the latest accounts give a bright vision of its future.

The writer cannot yet be in a position to make a statement as to the influence of this method of treatment upon the prognosis. Doubtless its value will soon be appraised; but at the time of writing there seems to be no justification—in what is striving to be a balanced opinion upon prognosis—for the assertion that a great advance has been made in the management of the disease, and already the bright vision is fading. We can understand how much the prognosis may be improved if, with clear evidence of damp and cold surroundings, we are able to substitute warmth, dryness, and cheerful company, for then we are certainly assisting the best of all healers—Nature.

There is another group of remedies which aim at altering the nervous influences, and success must largely depend upon how much of truth there is in the view that rheumatoid arthritis is largely the result of disordered innervation. Such methods as blistering the spine come into this category. We cannot escape from the fact that some have had great successes, and thus bettered the prognosis; yet we have met with patients who have fled from the stringent blister none the better, but rather the worse. Here, again, we need more definite details and indications before we can appraise the value of such methods in the question of prognosis.

Yet another line of treatment sees in the disease disturbance of the internal secretions, and strives by thyroid or ovarian extract to supply a possible lack of the normal supply.

One point stands out clearly with regard to treatment, and this is that the prognosis is not infrequently made decidedly worse by over-zeal. If we are to accept as a working basis that the condition is an infection, the patient must be studied as an individual, and the stage of the infective process must be recognized, and this, too, with the humbling knowledge of our ignorance of the exact nature of the infection. Forgetfulness of these points leads to our seeing a weakly patient reduced to the last stage of debility by an avalanche of therapeutic methods, some of them not apparently rational, and then the outlook is definitely rendered more gloomy. There can, however, be but little doubt that, with the more complete understanding of rheumatoid arthritis, the prognosis is slowly improving, and that the most encouraging field for this improvement lies in the determined study of possible sites of infection, and in the adaptation of the various imperfect remedies at present at our disposal to the particular individual, and to the particular phase of the illness.

The metabolic side of the problem of arthritis deformans has received a new impetus from the admirable papers by Pemberton published in the *American Journal of the Medical Sciences*, from 1912 onwards. This writer uses the term rheumatoid arthritis, but applies it in the sense in which arthritis deformans is used in this article. Among his conclusions are the following: (1) The disease is preventable; (2) In most instances it can be arrested; (3) It must be grouped with gout and diabetes, for in it he finds a limit of tolerance for carbohydrates and proteins. Taking this standpoint, he first ascertains the caloric value of the patient's ordinary diet, and then proceeds to limit the carbohydrates and proteins on the lines of the Allen method for diabetes. He finds both hypertrophic and atrophic arthritis respond; and for the large group of cases in which no causal focus of infection can be found, he claims special value for these measures; and he holds that when an infection is demonstrated, this affords no contra-indication, provided that the focus is also attacked. When, under the strict régime, the arthritis subsides, the diet is relaxed; but in most cases a restricted one will be found to be necessary if relapses are to be prevented. He maintains that the ordinary carbohydrate stuffs can cause the disease, which is not dependent on faulty elimination by the kidneys or bowel, or due to intestinal 'putrefaction'. In 17 cases, representing practically all the varieties of the disease, none failed to improve, and 3 only stopped short of a gratifying convalescence. These papers are full of detail.

In this country, probably the clearest lead upon diet is given in the general statement that severe rheumatoid arthritis requires generous nourishment. From a study of Pemberton's papers, it seems clear to the writer that if a step is to be taken to advance from this generalization, special 'homes' will be needed in which the intricate details of dietary must be studied on the lines which in America have attracted so much research. The danger of underfeeding in rheumatoid arthritis is so well established that he can see no other alternative than to re-examine this most difficult problem by laborious investigation of the entire question in well-equipped institutions. It is clear that Pemberton is

not advocating underfeeding, but a diet restricted in special directions and based upon accurate study of the particular case. One cannot deny that along these lines improvement in prognosis may be effected.

F. J. Poynton.

ARTHRITIS, SEPTIC.—(See GUNSHOT WOUNDS ; JOINTS, INJURIES OF ; KNEE-JOINT, INJURIES OF.)

ARTHRITIS, TUBERCULOUS.—We shall first examine some general considerations in the prognosis of tuberculous joint disease, and then discuss the end-results of the various methods of treatment for particular joints.

General Outlook.—The following factors are of great importance in arriving at an accurate prognosis : the age of the patient ; the history of the joint affection ; the presence of phthisis or other lesions elsewhere ; the presence of septic infection ; the onset of acute general tuberculosis ; the social position and carefulness of parents.

With regard to the age, we may say generally that children usually recover, while adults show little tendency to improvement apart from excision of the joint, except in mild, early cases where the diagnosis is likely to be precarious.

The history is important. Sometimes, especially in adults, there are marked contrasts ; one patient has a short history of a rapidly progressing destruction, and another shows little but a quiet chronic synovitis of long duration.

Concerning the third and fourth propositions, no comment is needed except to say that even septic sinuses do not necessarily make the prospects of recovery hopeless. Albuminoid disease is now rarely seen.

The gravest risk is that of acute generalized tuberculosis, and the early signs of this, such as fever (not accounted for by the state of the joint), vomiting, drowsiness, etc., should be regarded as a warning that the end may be near.

In early, well-treated cases, restoration of a movable joint is occasionally seen, but this is the exception and not the rule. In general, there is more or less complete fixation, especially if septic infection has supervened. Further, tuberculous hip leads, in many cases, to very decided shortening of the limb.

Although the majority of patients with a tuberculous joint eventually get 'cured', it is important to realize the limitations with which the word should be used. Even when there is no pain, swelling, or other symptom for years, it by no means proves that the bacilli are all dead. Strain, pregnancy or lactation, forcible bending of the joint by a bone-setter, or much more trivial causes, may lead to a recrudescence of the trouble.

Hip-joint.—A few years ago, the eventual mortality of this disease was put at 30 per cent, but nowadays it is undoubtedly less. Watson Cheyne found a death-rate of 12 per cent in 77 cases, but some of the patients had phthisis ; excluding these, the fatalities amounted to 8 per cent. No cases were fatal which were aseptic throughout.

The duration of treatment must be long. Thomas used to estimate that it took seven years to cure with his splint ; Cheyne considers this excessive ; but at the New York Orthopedic Hospital, according to Humphries and Durham (1917) the average period of treatment and supervision was over seven years. The amount of shortening is usually about one and a half inches ; it depends, of course, on the stage at which the disease can be brought to a standstill ; there will be no permanent shortening in quite early cases.

The prognosis in relation to treatment is very important. Some evidence was advanced at a recent debate of the Royal Society of Medicine that tuberculin is helpful : Butler Harris reported 10 cases improved by it ; Maynard Smith quoted 19, of which 16 were previously doing badly, where tuberculin rapidly improved all except 3.

There is no doubt that, given prolonged early treatment in special institutions, the immense majority of children with tuberculous hips can be cured without operation, and may recover a fairly useful limb. Sir H. Gauvain reported a long series treated without operation at the Alton country cripple home with excellent results ; of 880 cases with tuberculous hip, 710 were arrested, 18 improved, 2 not improved, 25 removed or transferred, and 13 died (mortality 1·7 per cent). The average stay was 403 days. The others were still under treatment. The only operation performed was aspiration of abscesses. At the New York Orthopedic Hospital 461 cases were treated, nearly all in children. Of these, 171 are described as cured, 44 still under treatment, and 60 died. The rest were

lost sight of. That is to say, of cases followed through, 74 per cent, about three out of four, got well, and a quarter died. The treatment used was a Taylor hip splint. Apparently none were excised. Of the 171 cases described as cured, the degree of recovery is expressed in the following table :—

Shortening less than 1 in. -	Cases 40	Bony ankylosis -	Cases 13	Range of movement :—	Cases
„ 1 to 3 in. -	119	Fibrous „ -	49	Thigh flexion 15°-90° -	73
„ over 3 in. -	21	Dislocation -	3	„ „ over 90° -	45
				„ „ perfect -	35

Of course, it is not possible to obtain results as good as these by conservative measures in ordinary hospital practice ; but very few British surgeons are disposed to regard excision with favour at the present time, except, perhaps, in adults.

Stiles, one of the principal supporters of the formal excision, gives his results in the following table :—

RESULTS OF EXCISION FOR TUBERCULOSIS (STILES).

Joint	Excisions	Good	Useful	Bad	Am-putated	Deaths	Not traced
Hip -	60	19	4	3	3	12	19
Knee -	64	24	5	1	12	4	18
Elbow -	54	10	15	1	1	6	21
Ankle -	29	9	4	1	6	3	6
Total	207	62	28	6	22	25	64

It will be seen that the death-rate, immediate and remote, is high ; most of the fatalities were due to generalized tuberculosis. Stiles's cases were all children. The average shortening was one and three-quarter inches ; the maximum was five and a half inches. Of the cases followed through, 23 out of 40 got a good or useful limb.

Thompson gives results of 40 cases operated on at Guy's Hospital between 1896 and 1903 ; eventually, 6 of these died and 8 required amputation, so that 35 per cent were a failure ; in 11 cases sinuses were still present ; in 15 the disease had become inactive. Deformity was usually marked, but utility good ; there were 13 fixed joints, 10 mobile, and 1 flail-like. Seven were earning fair wages.

We may conclude, therefore, that, after excision, a good result is likely to be obtained in only about half the cases.

There is, again, a very real danger of lighting up fatal acute miliary tuberculosis. Death took place from this cause, soon after the operation, in 2 of Stiles's and 3 of Watson Cheyne's cases. König has shown that, out of 18 patients with tuberculous hip who died of meningitis, death followed operation in 16.

Of late years we have learned that all the older statistics concerning the prognosis of tuberculous hip are vitiated by the inclusion of cases of the somewhat similar but less serious condition called Perthes' disease (= coxa plana). This is by no means uncommon in boys between 5 and 10 years of age ; it is often bilateral, and the symptoms closely resemble those of tuberculous hip without suppuration. Abduction is markedly limited, as are, to a less degree, the other movements. There is pain, and a limp. The diagnosis is made by the skiagram, which shows flattening and broadening of the head of the femur, and irregularity of the epiphysis and epiphyseal cartilage. It runs its course of about two or three years, and then gets well. All the symptoms and signs are quieter than those of tuberculous hip, but it is likely to be included under that diagnosis unless specially looked for.

Knee-joint.—The prospects as to life are better than in tuberculosis of the hip, but the prospects as to local recovery scarcely so good. In adults, if there is well-marked swelling, and evidence of extensive disease in and about the joint, the prospects of recovery, apart from operation, are not promising ; but mild early cases without much

pulpy swelling sometimes do well. In Garré's clinic at Breslau and Bonn, the end-results of 86 cases treated conservatively (rest, heliotherapy, and iodoform injections) have been published by Els. Two-fifths of the patients were under ten years of age. Approximately half (51 per cent) obtained a good result; 45 per cent were not satisfactory, and the rest died.

At the New York Orthopedic Hospital, treatment by some form of rigid knee splint has been the rule, and the great majority of the cases were children. The patients were treated or supervised for an average period of seven years. Of 156 cases treated, 7 died (about 5 per cent). Of the rest, 7 were still under treatment, 106 are 'cured', and the rest lost sight of. That is to say, about two-thirds got a good or fair result with arrest of the disease. Of these :—

	Cases		Cases		Cases
No shortening (or lengthening)	83	Ankylosis	26	Movements normal	39
Over 1 in. short	16	Flexion deformity	18	„ from 15°–90°	36

Apparently no cases were excised.

Sir H. Gauvain gives the Alton figures as follows: of 333 cases, 282 were arrested, 6 improved, 0 not improved, 11 transferred or removed, 7 died (2·3 per cent). The rest were still under treatment. The average stay at Alton was 334 days. These were not operated on (apart from evacuating abscesses with a needle).

We have some statistical evidence concerning the end-results of excision, both in children and adults. Stiles performs excision in children whenever the articular cartilages appear to be destroyed, or an abscess forms outside the joint. Arthrectomy is falling into disrepute, because the joint produced may be weak and painful.

It will be observed that in 63 operations there were 4 deaths, 1 within a month from generalized tuberculosis, and the others later; 1 death was from measles. Of 45 cases followed through, 29 got a 'good' or 'useful' result, but subsequent amputation was necessary in 12. Of 30 joints examined, 29 were fixed and 1 was slightly mobile.

The two principal troubles are shortening and flexion. The average amount of shortening was a little over two inches; in 5 it exceeded three inches; a little shortening, up to one and a quarter inches, does not necessitate a high boot. In 5 cases a subsequent wedge-shaped resection was needed on account of angular deformity, and in another there was flexion to ninety degrees. The results are not always as good as this. Elmslie, in a study of 89 cases of excision of the knee, found 3 with over six and a half inches of shortening and marked angulation, 25 had been subjected to re-excision, and 3 to a third excision.

The results of excision in adults have been published by Seldowitsch, of Petrograd, as follows. In 57 cases followed through, 35 obtained firm, painless, bony ankylosis with excellent function; 10 were improved; 2 were no better; 4 had subsequently to be amputated; 6 died (pneumonia 2, general tuberculosis 2, meningitis 1, cachexia 1).

In the Breslau and Bonn series, excision was performed in 268 cases (114 under fifteen), the indications being evidence of bony disease complicated by abscesses or fistulae or severe contractures or luxations. The immediate results showed 2 per cent deaths, 88 per cent recoveries, 6 per cent little or no better, and 4 per cent needing amputation. Examined a year later, out of 188 cases, 14 had died, but 84 per cent showed a good result.

Albee lays great stress on the importance of securing good fixation after excision or erosion. He saws off as little as possible from the two bones, and insets an inlay graft to secure bony union. He quotes the following figures :—

Of 14 excisions	without fixation	-	-	-	-	8 failed
„ 14	„ fixed by plates	-	-	-	-	1 „
„ 24	„ with inlay graft	-	-	-	-	0 „

We may conclude, therefore, that after excision for tuberculosis of the knee, about two-thirds, both children and adults, get a very good result, rather better in adults than children; but that great skill and care are necessary in children, or the results may be deplorable. The mortality, immediate and remote, is about 8 per cent.

Ankle and Foot.—At the New York Orthopedic Hospital, 50 cases, mostly children, were treated by a stiff ankle brace, the duration of treatment and supervision being just

over 4 years. Of these, 21 were lost sight of, 6 died, and 23 were 'cured'. Apparently no cases were operated on.

15	resulted in good movement		
6	"	limited	" without deformity
2	"	"	" with deformity

Syring has published the results of a series of 222 cases of tuberculosis of the foot and ankle treated in Garré's clinic at Breslau and Bonn, tabulated for the 1913 Congress. Conservative measures similar to those mentioned above for the knee-joint had to be given up in 114 cases, but in the remaining 108 they gave good results in 75 per cent, that is, about a third of the whole. Excision of the astragalus was adopted in 75 cases, of which 49 obtained a good, often a very good, result. The prospects of success are much better in children than in adults, but the majority even of those over twenty did well. Amputation was necessary on 45 occasions; of these, 30 were soon able to return to work.

In Stiles's series, 29 ankles were excised, 3 dying subsequently. Out of 23 followed, 13 got a 'good' or 'useful' ankle, and 6 required amputation. The average shortening was three-quarters of an inch.

We may conclude, therefore, that conservative treatment of the foot and ankle may succeed in about a third of the cases, and excision in about two-thirds.

Shoulder-joint.—Evidence concerning the exact prognosis is not forthcoming. Stiles operated on so few cases that he gives no figures. The majority of the cases occur in adults, and so it is not usually worth while to try prolonged rest, which may not succeed after all. Watson Cheyne, therefore, advocates excision in adults, except in mild early cases. A fairly mobile useful shoulder generally results, and the period of disability is very greatly shortened. According to Fraser, patients often develop pulmonary tuberculosis on the same side as the diseased shoulder, and for that reason the prognosis as regards life is worse than in knee or hip cases.

Elbow-joint.—Here the usefulness of the arm depends very much upon the position; ankylosis at a wide angle is most inconvenient. In practice, a more useful joint is usually to be obtained by early operation, which will probably ensure mobility. This is especially true if abscesses or sinuses are present, because, in that case, very prolonged fixation would be necessary to get a cure by conservative means. According to figures quoted by Watson Cheyne, 75 per cent of the patients treated by excision get a good joint, and the remaining quarter may have a stiff or a flail joint in about equal proportions.

Stiles excised the elbow 54 times; 6 patients died subsequently (three months to two and a half years) of generalized tuberculosis. Apart from these, 25 out of 27 obtained a 'good' or 'useful' joint; in 10 there was considerable power and mobility; in 6 ankylosis; and 7 were flail. The shortening averaged one and a half inches. Only 1 patient required subsequent amputation.

Wrist-joint.—In children, with proper conservative treatment, these cases practically all get well, with some permanent stiffness (Marsh). In adults, also, the patient is likely to get the best results by prolonged fixation, except when the whole joint is badly disorganized, with septic sinuses. The hand left after excision is usually much crippled on account of the shortening of the bones compared with the tendons, and amputation is often preferable. Exact figures are not available.

Dactylitis.—In children, in the great majority of cases, fixation and conservative treatment end in a cure (Cheyne). Amputation is seldom required. In adults, the course is so slow and the prospect of benefit so uncertain that amputation is to be preferred.

Sacro-iliac Disease.—Although exact figures cannot be quoted, it was generally admitted until recently that the prognosis in this affection was grave. Most of the cases occur in adults, and phthisis is often present. The great majority died after a chronic illness. In young subjects, recovery may occur, but often with oblique deformity of the pelvis (Cheyne).

Wheeler, of Dublin, points out that better results may be obtained by earlier diagnosis, and that the sciatica and gluteal pain, together with a skiagram, give definite evidence before the classical signs develop. He obtained an excellent result by early operation in one case, and a fair result in another.

Albee strongly confirms the value of operation, fixing the joint by means of a bone peg-graft driven into the two bones.

REFERENCES.—Watson Cheyne, *Tuberculous Disease of Bones and Joints*; Stiles, *Brit. Med. Jour.* 1912, ii, 1356 (and discussion); Marsh, *Joint Diseases*; *Proc. Roy. Soc. Med.* 1912, discussion, Children's Section, 65, 76; Sever, *Jour. Amer. Med. Assoc.* 1910, 2128; Thompson, *Guy's Hosp. Rep.* 1905; Els, *Beitr. z. klin. Chir.* 1913, lxxxvii, 51; Syring, *Ibid.* 88; Humphries and Durham, *Jour. Amer. Med. Assoc.* 1917, Jan., 282; Gauvain, *Lancet*, 1921, i, 1065. *A. Rendle Short.*

ASCITES.—Since ascites is not a disease, but the result of various pathological conditions, its prognostic significance in any given case depends on its cause. As, however, it may be a late or even terminal phenomenon in some conditions, its recognition renders the prognosis of the causal disease very grave. The commonest condition associated with ascites is some form of heart disease; out of 224 cases in which a quart or more of ascitic fluid was found after death, 89, or 39 per cent, were due to cardiac disease, the next most important cause being some form of intra-abdominal new growth, in 44, or 19.6 per cent (Cabot¹). In adherent pericardium, ascites may be due to chronic peritonitis (polyorrrhymenitis), and then persists for long periods; but in ordinary cases of chronic cardiac failure the onset of ascites shows that the disease has reached an advanced stage. Again, in portal and hypertrophic biliary cirrhosis of the liver, in chronic splenic anæmia with subsequent hepatic cirrhosis or Banti's disease, and in chronic malaria, the advent of ascites is a very grave indication. That the prognosis of ascites depends on the cause is shown by the different outlook in ascites due to malignant disease and to tuberculosis of the peritoneum respectively. The various forms of ascites are referred to incidentally throughout this article, but some of the more important forms will now be mentioned briefly.

The three conditions—uncomplicated cirrhosis, cirrhosis complicated by simple chronic peritonitis, and simple chronic peritonitis—stand in this order as regards the gravity of the prognosis. Thus the average duration of life after the appearance of ascites in thirty-one cases of uncomplicated cirrhosis was 188 days; in twelve cases of cirrhosis complicated with simple chronic peritonitis, 288 days; and in nine cases of uncomplicated simple chronic peritonitis, 624 days (Ramsbottom²). In the ascitic form of tuberculous peritonitis, the outlook is better than in all other forms of ascites except those associated with the presence of an innocent uterine or ovarian tumour which can be removed. The ascites due to gummas in acquired syphilis of the liver rapidly diminishes without tapping under efficient antisyphilitic treatment, and the prognosis is good. But in the rare cases of ascites due to congenital syphilis, whether in very early life or later, when the lesions of delayed congenital syphilis (gummas, cicatrices, and lardaceous disease) have developed, the outlook is very serious. As mentioned elsewhere (*see LIVER, CIRRHOSIS OF*), cicatrices are not influenced by antisyphilitic remedies.

Medical Treatment.—The influence of diuretics on the prognosis depends on the effect they exert on the underlying cause. Thus, they may diminish or remove the ascites by improving the circulatory conditions in the cardiac or cardiorenal diseases which are responsible for the effusion, though even here their action is somewhat capricious and uncertain; but in chronic peritonitis and malignant disease of the peritoneum little benefit can be expected. Diuretics are disappointing in the presence of considerable ascites, and are often more effective shortly after paracentesis, when, from removal of pressure on the renal veins, the kidneys are better able to respond to stimulation.

A salt-free diet (dechlorinization) is more likely to do good in renal cases, and a restricted intake of fluids (dry diet) should succeed better in cardiac and cardiorenal ascites than in other forms. The Karrel cure, consisting of 800 c.c. of milk only, given in equal quantities four times daily, has given good results (Goodman³). Purgation is usually disappointing, though besides removing fluid it may exert a detoxicating action, especially in cirrhosis. Excessive purgation may seriously impair nutrition, and in the past such vigorous treatment may have hastened the end. When ascites diminishes as the result of administration of iodides, the underlying cause is almost certainly syphilis, and the prognosis is therefore very good. Letulle⁴ finds that syphilitic peritonitis often accompanies cirrhosis thought to be alcoholic, and is curable by antisyphilitic treatment.

Operative Treatment.—In ascites associated with innocent ovarian or uterine tumours, operation renders the outlook extremely good; but this association is not very frequent. Ascites was found in 10, or 50 per cent, of 20 cases of ovarian fibromas; in 31, or 7·9 per cent, of 391 multilocular ovarian cysts; and in 55, or 7 per cent, of 723 uterine fibromyomas (Cabot¹). In papilloma of the ovary, ascites is frequent. In all these conditions removal of the tumour cures the ascites, and Cabot¹ points out that it may also cure a concomitant pleural effusion.

In the ascites of tuberculous peritonitis the question whether simple laparotomy or medical measures give the best results has been extensively discussed by surgeons and physicians, who have brought forward elaborate statistics to support their respective lines of treatment (*vide* PERITONITIS, TUBERCULOUS). An obvious advantage of laparotomy is that a local focus of tuberculous disease which may give rise to re-infection and relapse after partial or apparent cure may thus be detected and removed.

Out of W. Mayo's⁵ 26 cases in which tuberculous Fallopian tubes were removed, 25 recovered permanently, and in 7 of these simple laparotomy had previously been performed from one to four times for the cure of tuberculous peritonitis. The operative treatment of the ascites of portal cirrhosis is referred to elsewhere (*see* LIVER, CIRRHOSIS OF).

Paracentesis can hardly be regarded as a form of treatment which directly influences the prognosis of ascites; it is a necessary means of obtaining relief from mechanical obstruction rather than a curative measure. The risk of peritoneal infection or hæmorrhage (from wounds of the deep epigastric or other vessels), or of direct damage to the abdominal viscera from the insertion of a trocar and cannula, is almost negligible. Repeated paracentesis, however, may set up some chronic peritonitis, and so perpetuate ascites originally due to some other lesion, such as the backward pressure of heart disease. In hepatic cirrhosis, death from coma sometimes follows soon after tapping, but this is because the ascites is a terminal event, and is seldom the result of the paracentesis.

Frequency of Tappings.—On the whole, frequent tappings are rather favourable than otherwise, as they show that the condition is chronic and may thus exclude malignant disease. In chronic simple peritonitis in which ascitic life is longer than in other conditions, repeated paracentesis may be necessary; an extreme instance of this is Rumpf's patient, who was tapped 301 times in sixteen years. Another remarkable example of ascitic life was that of a woman who was tapped 299 times in nine years, sometimes twice a week, the causal disease being papillomatous disease of the ovaries (Pye-Smith⁶). While rapid re-accumulation is not necessarily of evil omen, its occurrence in cirrhosis at such a rate as to require a fresh tapping after two or three days' interval, especially if accompanied by hæmatemesis and melæna, may be due to portal-vein thrombosis, which is extremely likely to precipitate a fatal issue. Ascites may be a terminal event, and therefore of very grave significance. Thus, in uncomplicated cirrhosis, tapping is seldom required more than twice, and the prolongation of life is shorter than in cirrhosis complicated with chronic peritonitis, in which more tappings are required, and in chronic peritonitis. In some cases of fatal cirrhosis, ascites does not require tapping. The prognosis, however, is not necessarily bad because tapping is not required, for in tuberculous peritonitis it is seldom called for, and in syphilitic disease of the liver, antisyphilitic treatment may be followed by rapid disappearance of the fluid. The introduction into the peritoneal cavity at the end of paracentesis of a dilute solution of adrenin has in some instances prevented or delayed re-accumulation, but its action is not sufficiently constant to be relied upon.

In Individual Cases.—Age bears on the prognosis in so far that, apart from cardiac disease, ascites in children is nearly always due to tuberculous peritonitis, in which the outlook is fairly good.

The association of jaundice with ascites is infrequent except in malignant disease and in cirrhosis, and is therefore a bad prognostic; deep jaundice almost certainly points to malignant disease. Œdema of the feet may precede the onset of ascites in cirrhosis, and is then a bad sign; but in the backward pressure of heart disease this sequence is of comparatively little importance. Extensive ascites may induce œdema of the feet mechanically, by pressure on the inferior vena cava, and in rare instances gives rise to a pleural effusion (Cabot¹), and these results may disappear if the ascites is cured.

Association of pleural and ascitic effusions should not necessarily cause more anxiety than the presence of ascites alone ; for it is sometimes seen in simple chronic peritonitis ; and cases of tuberculous peritonitis thus complicated may do well. On the other hand, it may occur in cirrhosis, usually from tuberculous pleurisy, and in widespread malignant disease. Fever is not uncommon at the onset of tuberculous peritonitis, and it is only when persistent that it causes serious anxiety as to the future of the case. In cirrhosis the onset of ascites with fever points to a rapid course or to some complication, such as tuberculous infection, especially of the peritoneum. In ascites due to hepatic syphilis, any associated fever is easily removed by efficient antisyphilitic treatment. Albuminuria has not any special bearing on the prognosis of ascites ; for the ascites of chronic renal disease may clear up ; chronic simple peritonitis, in which ascites lasts for long periods, may be associated with chronic renal disease ; syphilis may give rise to both ascites and albuminuria ; and in some instances albuminuria may be directly due to the pressure of the ascitic effusion on the renal veins. The presence of sugar in the ascitic fluid occurs in cases of cirrhosis with hæmochromatosis, the glycosuria usually supervening about a year before death, and so is a bad prognostic. On the other hand, transient glycosuria may occur from alcoholic excess in cases of cirrhosis with ascites due to concomitant chronic peritonitis. The presence of melanin in the urine, which is easily established by the occurrence of a dark colour after the addition of either nitric acid or of ferric chloride, proves that there is a malignant melanotic growth, almost certainly in the liver.

Physical Characters of the Ascitic Fluid.—Clear ascitic fluid is met with both in conditions, such as hepatic cirrhosis, backward pressure from cardiac disease, and occasionally malignant growth, in which the outlook is grave, and also in tuberculous peritonitis, in which the prognosis is comparatively good. In cirrhosis there is often a yellow tint due to bile, and this may also occur in cardiac disease, so that this coloration is somewhat ominous. Generally speaking, without the assistance of a cytological examination (*vide infra*), these naked-eye appearances do not justify an opinion as to the prognosis. Turbid ascitic fluid points to subacute inflammation, and is also seen in less favourable cases of tuberculous peritonitis. In milky ascites the prognosis is grave ; out of 173 collected cases, 116, or 67 per cent, proved fatal, the mortality for the pseudo-chylous cases (70·4 per cent) being higher than that (66 per cent) of the chylous cases (Wallis and Schölberg⁷).

Blood-stained ascites, which must be distinguished from an effusion of blood (hæmo-peritoneum), especially at the first tapping, suggests intra-abdominal malignant disease, and thus makes the outlook extremely grave ; but it may occur in portal cirrhosis, usually as the result of a previous tapping, and in association with ovarian cysts and uterine fibromyomas. Out of 31 cases of ascites due to ovarian cysts, 8 were blood-stained, and out of 55 cases of ascites due to uterine fibromyomas, 10 were blood-stained (Cabot). In these cases the ascites can be permanently cured by removal of the innocent tumour. A blood-stained ascites therefore does not always cause grave anxiety. A mucinoid ascites, which occurs in some cases of intra-abdominal malignant disease and also in association with leaking ovarian cysts, renders the prognosis serious but not certainly hopeless.

Prognosis from Cytological Data.—A predominance of endothelial cells occurs in passive effusions, as in heart disease and cirrhosis, and, since ascites due to these causes is a late event, it is a somewhat grave sign. A high lymphocytosis usually points to tuberculous peritonitis, in which the outlook is comparatively favourable ; but in some cases of portal cirrhosis in which there is no evidence of tuberculosis in the abdominal cavity after death, lymphocytes are the predominating cells. The presence of multinuclear cells and of atypical mitoses strongly suggests malignant disease of the peritoneum. Fragments of villous growth make the prognosis good, as their presence shows that the ascites is probably due to implantation of ovarian papilloma on the peritoneum ; for if the primary tumour is removed, the secondary implantations and the ascites disappear. If the opsonic index of the fluid for tubercle bacilli is lower than that of the blood, the cause is tuberculous peritonitis and the outlook fairly favourable, provided there is no reason to believe the case is one of cirrhosis with superadded tuberculous infection. When the Wassermann reaction is better marked in the fluid than in the blood (Esmein

and Parvu⁸), the cause is syphilitic disease, and therefore likely to be cured by specific treatment.

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H. D. Rolleston.

ASTHMA, BRONCHIAL.—This disease is not fatal in itself, but its complications may shorten life. The paroxysm seldom if ever causes death, although there is at least one instance on record in which artificial respiration was required. There are numerous cases of asthmatics having reached old age, but insurance records show that the majority do not live out their expectation. As a general rule, it may be stated that when the first attack takes place in early childhood there is a fair prospect that the disorder will cease when puberty is reached; but a number of cases have occurred in which asthma first developed at the age of four or five and continued at intervals to the age of seventy or over. If middle age is not passed before the first attack occurs, there is always hope of a cure. After the age of forty-five, however, the tendency is usually towards a progressive increase in the severity of the symptoms. The disappearance of all symptoms does not necessarily mean a permanent cure, for the disorder may be absent for many years and then reappear.

In estimating the prognosis in cases of asthma in which marked complications have become established, the most important factor is the recognition of the cause in the particular patient. It has been shown by F. B. Talbot and others that there is a definite etiological connection between many cases of asthma occurring in childhood and some foreign protein derived from the food. The protein responsible is discovered by the sensitive skin test, and in many cases it appears to be egg-albumen. If the offending food is removed from the diet, the general condition of the patient almost invariably improves, and often a cure results. In cases where it is impossible to remove the protein from the diet, immunity can be induced by giving increasing doses of the protein in the manner described by Schloss. In some instances, both in childhood and adult life, the paroxysms can be definitely associated with particular climates, or particular odours, or forms of dust. For example, some soldiers cannot be present when a horse is groomed without suffering from an asthmatic attack; other persons have a paroxysm when they sleep on a feather bed. It would appear that this 'dust asthma' is also an anaphylactic phenomenon; and it has been found possible in some cases to isolate the protein from the dust, and subsequently to produce immunity as in the case of food. In a small percentage of cases, asthma is mainly due to a bacterial infection, and in these the use of vaccines has been of considerable service.

In many cases of asthma the nasal mucous membrane is hypersensitive, and in these the attacks can frequently be stopped altogether by appropriate treatment, provided that the patient has not been a sufferer for long, and has not acquired a 'habit'. In other cases, when it is impossible to remove the primary cause, treatment such as light cauterization of the nerve of the nasal septum appears to diminish the sensitiveness of the nasal mucous membrane, and to give relief in a considerable proportion of cases. This relief may be dramatic at times, but it would appear seldom to be permanent, although it may extend over several years. The use of intranasal remedies, such as dilute preparations of cocaine, often give relief for similar reasons, but they seldom if ever produce a permanent cure. At one time it was thought that the removal of gross abnormalities in the nose of asthmatic patients would be attended with excellent results. These expectations have not been confirmed, and it is doubtful whether success is obtained in more than five per cent of these operations, whereas in a not inconsiderable number the asthmatic attacks are aggravated. Further, it is a curious thing that if a polypus is removed before the light cauterization treatment, the symptoms may become worse; whereas if the cauterization of the septal nerve precedes the removal of the polypus, good results may be obtained.

As a further argument of the importance of ascertaining the cause in each case, it should be mentioned that if the disorder appears to be associated definitely with gout, high blood-pressure, chronic constipation, or other pathological condition, appropriate

treatment directed against the cause may do much to lessen the frequency of the attacks, although it seldom produces a lasting cure.

In all well-established cases, we have to take the question of the family longevity into account in estimating the prognosis, but in every case the most important factors are the amount of emphysema, the degree of bronchial catarrh, and the condition of the right heart. These complications all increase the tendency to asthmatic attacks, which in turn increase the severity of the complications, and so the patient lives in a vicious circle. By the relief of complications much can be done to prolong life. The introduction of appropriate vaccine treatment for bronchitis has helped to prolong the life of many asthmatics. In a number of instances considerable relief of the bronchial catarrh has been obtained, together with an increased immunity against particular organisms; hence longer intervals occur between the attacks of bronchitis, and consequently there is greater freedom from the paroxysms. Again, the use of 'pressure baths' for the treatment of emphysema has given considerable relief, and hence a longer life in some cases. In fact, it may be stated with some conviction that modern methods of treatment have tended, by the removal of the initial cause, or by the relief of serious complications, to do much to improve the general prognosis in persons suffering from asthma.

It may be of interest to add, that a person who suffers from asthma seldom develops tuberculosis, cancer, or Bright's disease.

Arthur Latham.

ATAXIAS.

Tabetic Ataxia.—As indicated elsewhere (*see* **TABES DORSALIS**), ataxia is a relatively late symptom of tabes, and in a large proportion of tabetic cases, if the malady be recognized in the early stage, ataxia need never develop at all. The symptom is best prevented by careful avoidance of physical over-exertion, and by systematic exercises of the limbs, carefully stopping short of any sensation of fatigue.

Once ataxia has supervened, its intensity is proportional to the muscular hypotonia, and to the degree of impairment of joint sense and of kinæsthetic sense.

The prospects of alleviation or cure of tabetic ataxia vary widely in different cases. The occurrence of optic atrophy seems to have a mitigating effect upon its incidence; this, however, only applies to cases of moderate ataxia in which optic atrophy supervenes relatively early in the course of the disease. In some tabetic cases where ataxia has developed with great rapidity, rest in bed for a few weeks or months has a markedly beneficial effect; and the patient, previously unable to walk without support, may spontaneously regain to a large extent his powers of progression. In other cases again, where the ataxia has been slowly and steadily getting worse, an acute intercurrent illness, confining the patient to bed, may rapidly aggravate all the symptoms, so that he may pass from the ataxic to the so-called paralytic or helpless stage. In the majority of cases, however, the ataxia is slowly and gradually progressive. What is the prospect of improvement in this class of tabetic patients? Carefully devised exercises, under skilled supervision, can generally improve the ataxic symptoms, the amount of such improvement being dependent on the intelligence of the patient and upon the patience and ingenuity of the physician. It is not uncommon for a previously bedridden patient thus to regain the power of standing or even walking, with or without support. Or a patient in whom the gait is moderately ataxic may, as a result of these exercises, combined with encouraging suggestion, gain confidence to such a degree that he succeeds in correcting and concealing his ataxia, so as no longer to be an object of remark to the unskilled observer. Real cure of ataxia does not occur, but the acquisition of new modes of movement has a compensatory effect, and may to a large extent conceal the old ataxia.

Family and Hereditary Ataxia.—Whether this be the type known as Friedreich's, Marie's cerebellar type, or the intermediate spino-cerebellar variety, the ataxia has a slow and insidious onset in childhood and adolescence, the legs being affected earlier and more severely than the arms. The degenerative process being essentially progressive, the prognosis is unfavourable as regards relief of the ataxia, and it is futile to attempt re-educative exercises. The malady itself does not necessarily shorten life, and the patient may survive for many years, even when helplessly ataxic. The prognosis as to life depends upon the assiduity with which the patient is nursed and looked after, and upon the care with which intercurrent maladies can be avoided.

Ataxia due to Focal Lesions of the Cerebellum.—This may be vascular in origin (as in thrombosis or hæmorrhage), or inflammatory (as in abscess, acute encephalitis, or localized meningitis), or associated with cerebellar tumour. In such cases, the prognosis of the ataxia depends on whether the underlying cerebellar disease can be removed by surgical or medicinal means. If so, the ataxia may entirely disappear, even in cases where a considerable amount of cerebellar tissue has been permanently destroyed.

Ataxia due to Focal Lesions elsewhere in the Brain.—In cases where ataxia is one of the symptoms of focal disease in other parts of the brain—e.g., in the corpora quadrigemina, optic thalami, crura cerebri, etc.—the prognosis is, as a rule, unfavourable; since, even if the lesion happens to be a stationary one, compensatory action by other parts of the brain does not, as a rule, occur. *J. Purves Stewart.*

ATROPHIES, MUSCULAR.—(*See MUSCULAR ATROPHIES.*)

AURICULAR FIBRILLATION AND FLUTTER.—(*See PULSE, IRREGULARITIES OF.*)

BANTI'S DISEASE.—(*See ANÆMIA, SPLENIC, OF ADULTS.*)

BENCE-JONES' PROTEINURIA.—(*See ALBUMINURIA.*)

BERI-BERI.—The mortality of beri-beri varies considerably in different countries. According to Castellani it is 2·5 to 3·5 per cent in Japan, 2 to 6 in Java, 19·7 in the Malay States, 48·6 in Hong-Kong, and 60 to 70 per cent in Sumatra. It is mainly dependent on the proportion of the wet or dropsical type, in which the death-rate is far higher than in the dry or paralytic variety. The great cause of death is sudden heart failure, especially seen in patients not kept in a strictly recumbent position during the acute stage, and in malignant cases it may carry off the patient in from a few hours to a few days. Even after apparent recovery, attacks of palpitation may continue to occur for a long time and even prove fatal.

Bad prognostic signs are extensive dropsy, especially with œdema of the lungs or hydropericardium, cardiac oppression, palpitation, dyspnœa, great increase in the pulse-rate on slight exertion, and vomiting.

The dry form of beri-beri is seldom fatal, but may leave deformities due to permanent paralysis of some of the muscles.

An infantile form of beri-beri has been described in the Philippines by Chamberlain and Vedder, which they state accounts for 56 per cent of the total infant mortality.

Extract from rice polishings is very effective in infantile beri-beri, and to a less extent in the adult forms. Complete and prolonged rest in bed is the most important factor in reducing the mortality of the dangerous wet form. Recent discoveries relating to the dietetic origin of the disease have enabled it to be practically eradicated from among the Philippine scouts, and in gaols, asylums, etc., by attention to diet alone. Thus among 5000 Philippine scouts living among a beri-beri-infected population the incidence of the disease was reduced from 600 cases a year to 6 cases in four years by the use of high-grade unpolished white rice and potatoes (Chamberlain). *Leonard Rogers.*

BILHARZIASIS.—The urinary and rectal diseases produced by the bilharzia, although very distressing, have a low mortality, chiefly due to terminal septic infection of the bladder and ulceration of the rectum. If the patient is removed from the endemic area of the disease before it is too advanced, the ova generally cease to be passed within three years, and recovery takes place.

The prognosis as regards recovery has been very greatly improved by the establishment by Christopherson of the power of tartar emetic intravenously to kill both the adult worms and their ova in the human system through a course of full doses every other day for two to four weeks. If it proves practicable to carry out the treatment on a large scale, the incidence of the disease ought in time to be much diminished, and the mortality now due to it prevented. *Leonard Rogers.*

BLACKWATER FEVER.—Most authorities with much actual experience of the disease in the tropics look on blackwater fever as a complication of malaria chiefly prevalent in intensely malarious parts of Africa and India, as shown by Stephens and

Christophers. The mortality is variously estimated by different authorities, varying from 4 to 6·8 per cent by the Plehns, 21 by Koch, and 23 to 24 by Bérenger-Féraud, up to as much as 50 per cent. Reports of 1913 from British Tropical African possessions showed an average mortality among 149 cases of 23·5 per cent, varying between 10 and 35 per cent, while twelve years' Tonkin figures showed a death-rate in Europeans of 33·2 per cent from 1902 to 1907, but only of 12·8 per cent in the next seven years, and one of 22·6 and 20·9 in the same years in natives.

The severity in individual cases varies within wide limits, from a slight temporary hæmoglobinuria with little constitutional disturbance, to very extensive blood destruction followed by blocking of the renal tubules with hæmoglobin and fatal suppression of urine. Nearly four-fifths of the mortality, according to Daniels, is due to this kidney trouble. Great diminution or absence of urine is the most serious symptom, which will prove fatal if it lasts for two days, even decapsulization of the kidneys having failed to save such patients. Other grave symptoms are severe anæmia from rapid destruction of the blood, persistent vomiting and hiccough, diarrhœa, continuance of high fever, cerebral symptoms, and low-tension pulse. Relapses of a fatal nature may occur in patients who have recovered from one or more attacks. Measures to increase the urinary flow, including saline and alkaline injections, do most to lessen the mortality, and were found of value in the war, hypertonic salines having been proved to check hæmolysis. The work of Christophers and Bentley in the Duars in India showed that persistent prophylactic use of quinine in this very malarious district greatly diminished the occurrence of the disease, thus confirming its malarial origin. (*See also* MALARIA.)

Leonard Rogers.

BLADDER, CALCULUS OF.—A stone may form in the bladder, or it may descend into the bladder from the kidney. A stone which forms in the bladder is likely to remain there until removed by operation. On the other hand, a stone which passes into the bladder from the ureter will, in a large proportion of cases (70 to 80 per cent), pass out by the urethra in the course of a few hours or a few days. The presence of urethral obstruction, such as enlarged prostate, or of atony of the bladder, as in tabes, or of a diverticulum of the bladder, will prevent the expulsion of the calculus, which remains and develops in the bladder.

Stone in the bladder is a painful malady, and it is seldom that the disease is allowed to run its course without an attempt at relief by operation. There are, however, cases where the symptoms are comparatively slight, so that the patient either disregards them, or, knowing that a stone is present, prefers the pain or discomfort to the risk of operative interference. Such stones may remain in the bladder for fifteen or twenty years, or even longer, and reach a great size. Eventually, however, and usually at a much shorter period than this, an unrelieved vesical calculus causes death, either by ascending pyelonephritis, or by back pressure causing dilatation of the kidney and interstitial nephritis, or by a combination of the two. In the great majority of cases an operation is performed, and the prognosis of vesical calculus lies in the success or failure of the operative measures undertaken.

The following factors are important : (1) *The date of the operation* ; (2) *The presence of sepsis* ; (3) *The presence of bladder complications* ; (4) *The presence of kidney complications* ; (5) *The result of the operation*.

1. The Date of Operation.—When a small calculus is lodged in the bladder, its removal is a simple matter, and the danger to which the patient is exposed is very slight. The operation can be performed under local anæsthesia, so that the small danger of a general anæsthetic is avoided. An evacuating cannula and bulb may suffice to remove the calculus from the bladder, or the use of a small lithotrite may be necessary. There should be no mortality for such an operation.

At a later stage, the size, number, and density of the stones, the presence of sepsis and of other complications, render the outlook for operation more serious. In the advanced stage, when the kidneys are diseased, operation of whatever kind is a serious undertaking, and is attended by a considerable mortality.

2. The Presence of Sepsis.—There are two classes of cases. In one, an aseptic calculus becomes infected either spontaneously or after the passage of instruments ; in the second, the calculus develops in a bladder already infected.

The majority of calculi in the first class are composed mainly of oxalate of lime or uric acid, and they increase very slowly in size or number. When the urine becomes infected, and especially when the reaction of the urine becomes alkaline, a rapid increase in size takes place from the deposit of phosphates on the surface of the stone. Phosphatic calculi formed in an infected bladder develop very rapidly, a calculus of considerable size developing in a few weeks.

Sepsis affects the prognosis in two ways. The mortality of operations on infected stones greatly exceeds that of operations on aseptic stones; and secondly, the probability of recurrence after operation is much greater.

3. Bladder Complications.—A healthy bladder, or one with a moderate degree of cystitis, will permit of an easily performed and complete litholapaxy, the mortality of which is very low and the probability of recurrence is slight. When severe cystitis is present, and the bladder is acutely spasmodic, litholapaxy becomes difficult and may be impossible, and lithotomy is necessary, with a higher mortality.

When the bladder is sacculated, or when a diverticulum is present, litholapaxy should not be performed, and suprapubic lithotomy is necessary. In such cases sepsis is always present, and it is difficult, and frequently impossible, to get rid of the infection. The prognosis is grave, for recurrence of the stone is probable, and ascending pyelonephritis may supervene. When a solitary diverticulum of large size is present, an operation for the removal of this will be necessary.

New growths of the bladder occasionally complicate calculus. In such cases the prognosis depends upon the nature of the growth, and upon the ability of the surgeon to diagnose its presence before attempting litholapaxy.

Bilharzial disease of the bladder is a grave complication of stone, met with in countries where bilharziasis is rife. Septic complications are common, and fistulæ follow cutting operations with great frequency. Perineal lithotomy is the operation usually chosen by those experienced in such cases.

Enlargement of the prostate complicates vesical calculus by increasing the probability of renal complications, and, if the obstruction is left untreated, by favouring recurrence of the stone. Litholapaxy is possible when there is a moderate enlargement of the prostate; but it is unsafe, and may be mechanically impossible, when the enlargement is pronounced. The proper treatment of stone in the bladder with enlarged prostate is suprapubic prostatectomy with removal of the calculus.

4. Kidney Complications.—Infection of the kidneys is the most serious complication of vesical calculus, and is the commonest cause of death after operation, or when no operation has been performed. The infection takes the form of a pyelitis in milder cases, and a pyelonephritis in the more severe.

Stone in the kidney is a not infrequent complication. In many of these cases the stone in the bladder has developed on a small calculus passed from the kidney. In other cases the bladder is the seat of chronic cystitis from repeated descending infection from the kidney, and the vesical calculus forms in the infected bladder. Kidney symptoms may be absent or insignificant, and the presence of renal calculi and infection is very frequently overlooked. The prognosis in such cases is grave. An operation upon the kidney is required, in addition to that on the bladder, and nephrectomy may be necessary.

In such a case the presence of cystitis, if this cannot be cured, is a menace to the remaining kidney, from ascending infection.

5. The Results of Operation.—The operation chosen, and the results of operation, depend upon the factors which have already been discussed above. Litholapaxy is the operation of choice. Suprapubic lithotomy is performed when there are bladder complications, such as sacculations, diverticula, bladder spasm, enlargement of the prostate, intractable cystitis, new growth of the bladder; when the size and hardness of the stone make crushing impossible; or when septic renal complications render bladder drainage advisable.

Perineal lithotomy is reserved for special cases, such as those with stone in the urethra complicating vesical calculus, and also for cases of bilharziasis.

The mortality statistics of litholapaxy are much lower than those of lithotomy, but they hardly give a fair index of the relative gravity of the two operations; for many

surgeons reserve lithotomy for the more serious complicated cases, while performing litholapaxy in all simple ones.

Statistics collected by Keegan of stone operations in India show that the mortality in 10,073 litholapaxies was 3·96 per cent ; in 7201 cases of lateral lithotomy it was 11·02 per cent, and in 147 cases of suprapubic lithotomy, 42·17 per cent. In the Indore Charitable Hospital, Central India, in the period 1881 to 1900, there were 500 litholapaxies in boys, with 11 deaths, a mortality of 2·2 per cent ; and 18 litholapaxies in young girls, all successful.

The following figures show the results of 1960 stone operations performed at St. Peter's Hospital from 1864 to 1916 :—

RESULTS OF OPERATION FOR STONE IN THE BLADDER.
(*St. Peter's Hospital, 1864-1914.*)

Date	Operations	Cured or Relieved	Died	Mortality per cent
1864—73	118	100	18	15·25
1874—83	196	166	30	15·30
1884—93	362	332	30	8·29
1894—03	600	571	29	4·80
1904—13	578	559	19	3·28
1914—16	106	102	4	3·92

The death-rate of litholapaxy in the hands of various surgeons is as follows : Guyon, 2·7 per cent ; Zuckerkandl, 3·6 per cent ; v. Frisch, 2·6 per cent ; Legueu, 2 per cent ; Freyer, 2·61 per cent. Watson collected from the literature 17,736 cases of litholapaxy, with 426 deaths, a mortality of 2·4 per cent. The influence of age upon the result was shown by the following figures : Between one and fifteen years there were 2518 cases, with a mortality of 1·7 per cent ; between sixteen and fifty, 719 cases, with a mortality of 1·6 per cent ; over fifty there were 3395 cases, with a mortality of 4·4 per cent.

The mortality of suprapubic lithotomy is much higher : Zuckerkandl, 13·5 per cent ; v. Frisch, 12·7 per cent ; Barling, 17·8 per cent ; Dittel, 15·6 per cent ; Preindelsberger, 12·9 per cent ; Guyon, 24·3 per cent ; Nicolich, 7·45 per cent ; Freyer, 12·75 per cent. Watson collected 3303 cases, with 436 deaths (13·2 per cent).

The high mortality of suprapubic lithotomy, compared with litholapaxy, is due to the fact that all the grave cases were treated by lithotomy. When the same class of cases is treated by one or other operation, the results are less disproportionate. Thus Assenfeldt, in 460 cases of suprapubic lithotomy, found a death-rate of 3·6 per cent.

Late Results of Operation.—Watson found 19 per cent of recurrence in 902 cases of litholapaxy, and in more than two-thirds of these the patients were fifty years of age or over.

Zuckerkandl found 12 per cent of operated cases recurred. There is no difference in recurrence after the operation between lithotomy and litholapaxy, in the hands of an experienced surgeon. The use of the cystoscope immediately after the operation, or a few days later, checks the result, and provides against allowing the patient to depart with fragments unremoved.

Recurrence takes place most frequently from new formations of phosphatic stone, usually in the subjects of enlarged prostate. Recurrence of oxalate-of-lime or of uric-acid calculi is much less frequent, but may occur from the descent of calculi from the kidney, or from new formation in the bladder. The latter is very rarely the result of fragments left behind at a crushing or cutting operation. The recurrent calculus, after removal of a uric-acid or oxalate-of-lime calculus, may be phosphatic, and is due to changes in the urine.

The effect of removal of an enlarged prostate upon the recurrence of calculi varies according to their composition and the state of the urine. Uric-acid and oxalate-of-lime calculi rarely recur ; phosphatic calculi frequently.

J. W. Thomson Walker.

BLADDER, EXSTROPHY OF.—There is some variation in the degree of extroversion of the bladder. In the common form the anterior wall of the bladder is deficient, so that the bladder mucous membrane is exposed and bulges above the rudimentary penis, and the urine is discharged on the surface from the uncovered ureteral orifices. The conditions of existence are miserable in the extreme. There is continual escape of urine, saturating the clothes, and leading to inflammation and excoriation of the skin of the thighs and buttocks. The child lives in a pungent atmosphere arising from decomposing urine, and his life is a burden to himself and to those around him. Associated deformities such as hare-lip, cleft palate, and spina bifida may be present, and contribute to a fatal issue in infancy or early childhood.

Progressive dilatation of the ureters and kidneys occurs. Ascending pyelonephritis is the commonest complication, and is the usual cause of death—which takes place, as a rule, during childhood or youth. Occasionally the patients survive till adult life, and even attain old age. A malignant growth may develop in the exposed bladder.

The operations performed for extroversion of the bladder are numerous, and their number is an indication of the poor results generally obtained. The principal symptoms against which treatment is directed are the incontinence of urine, the pain and discomfort, and the infection; and by the success in abolishing these the value of the different operations may be measured. These operations will be considered in three groups:—

1. Autoplastic Repair of the Bladder.—The ingenuity of many surgeons, among whom are Roux, Sédillot, Billroth, Thiersch, Wood, Le Fort, and Legard, has been devoted to closing the bladder by flaps of skin; and Pozzi, in addition, attempted to form a fibromuscular shield in front of the reconstructed bladder, from the adjacent abdominal wall.

The mortality of these procedures is not great, but the results are not satisfactory. There is frequently failure to obtain healing in even the most carefully planned operation, and many secondary operations are required. Occasionally the bladder is covered in at a single operation. The total gain in a successful operation of this nature is that the bladder mucous membrane is protected. The incontinence of urine continues, but the patient is enabled to wear a urinal, and thus some part of the misery is relieved. The infection, however, continues unabated, and a stone not infrequently develops in the partly reconstructed bladder.

2. Suture of the Margins of the Bladder, with or without Previous Operation on the Pelvic Girdle.—A few surgeons (Gerdy, Billroth) have endeavoured to close the gap by dissecting and suturing the edges of the bladder wall. This operation has, however, been attended by no success.

In order to allow of the approach of the separated pubic bones, as a preliminary to closure of the bladder, Trendelenburg performed arthrotomy of the sacro-iliac articulations. The posterior ligaments of one synchondrosis are cut, and if this does not suffice to allow the pubic bones to come in contact, the other side is similarly treated, and the patient is suspended in a special apparatus for three or four months, when an attempt is made to close the bladder. The operation is a more serious one than any of the preceding, and the wings of the pelvis have been known to become separated again after some time. On the other hand, some successes have been obtained, and in three cases it has been claimed that the patient was continent after the operation.

Ester states that continence has been obtained in 13 per cent of the cases operated upon by this method. Short of this the mucous membrane of the bladder is protected, with resulting improvement in the pain and inflammation.

3. Deviation of the Course of the Urine.—The number of operations of this nature is so great that only a few of the most successful can be discussed.

a. Peters's Operation.—Catheters are placed in the ureters, which are dissected out, leaving a small ring of the vesical mucous membrane attached to each. The bladder is excised, and the rectum exposed extraperitoneally. The ureters are passed through the rectal wall, and the catheters are drawn through the anus, without suture. The catheters are left in position for several days. A disadvantage of this operation is that the sphincter action of the lower ureters is destroyed. In 4 cases, Peters obtained 2 good results, with 1 failure, and 1 death from pyelonephritis. Sherman collected 11 cases operated by this method; of these, only 2 died of pyelonephritis.

b. Maydl's Operation.—The bladder is excised, leaving an area at the base which includes both ureteric orifices. The sigmoid colon is exposed, and the bladder base, bearing the ureteric orifices, implanted into this. Some surgeons have modified this by implantation into the rectum.

The immediate mortality of Maydl's operation varies from 5.5 per cent (Josséraud, 18 cases) to 26.7 per cent (Katz, 57 cases). In Petersen's collection, 31 patients recovered from the operation: 2 of these died of pyelitis within a year; while in 6 cases the operation was followed by fistula, which subsequently closed in every instance.

Surgeons are by no means unanimous in regard to the protective power of the ureteric orifices, thus implanted, against ascending infection. In experimental work on dogs, the mortality due to ascending pyelonephritis is very high. Clinically, some surgeons have recorded a high percentage of fatal cases from this cause. Pauchet, out of 4 cases, had 3 deaths from ascending infection, occurring after twelve, fourteen, and fifteen months respectively. On the other hand, cases have been recorded where the patients were in good health some years after the operation. Thus, Rèsigotté records a case alive and well after three years, Frank 1 after four years, Maydl 2 after four and five years, Graubner and von Eiselsberg each 1 after five years, Ewald 1 after nine years, Estor 1 after seven years, Tuffier 1 after seven years, Forgue 1 after eight years, Wolfier 1 after ten years, and Roux 2 after three and ten years respectively.

The presence of urine in the rectum does not appear to have caused any reaction, and inflammation of the mucous membrane is very rare.

After the operation continence is the rule. This may be established at once, or gradually develop. The rectum becomes dilated, and a considerable quantity of urine, which may be quite clear, is discharged voluntarily. Occasionally, from want of development of the perineal and anal muscles, continence is not established. This occurred in one case in Petersen's collection. The condition of the rectal sphincters should be carefully examined before embarking upon the operation.

Maydl's operation is the most successful of any of those performed for extroversion of the bladder, and is the only one in which a considerable proportion of cases shows continence, together with disappearance of the pain and discomfort, and an absence of ascending infection.

c. Soubottine's Operation.—A rectovesical fistula is created, the rectum is opened along its posterior wall after removing the coccyx, and a broad vertical band of rectal wall, including the fistula, is raised on the anterior rectal wall, the edges being united so that a tube is formed, the orifice of which is within the anal sphincter. The gap in the anterior bladder wall is then closed.

Of this operation Estor says that it is as efficient in obtaining continence as that of Maydl, and has the advantage of separating the urine from contact with faecal matter. At the same time the operation is very complicated and may fail at some part. The infected bladder is retained, and may be a source of trouble from calculus or other cause. Further, damage is done to the anal sphincters, already weak in many cases. In creating the rectovesical fistula, the peritoneum may be opened and infected. Three cases operated on by Soubottine died of peritonitis. In the first 6 cases where the whole operation was performed at one sitting, 2 died; whereas, in 10 cases in which a more recent operation in successive stages has been employed, all survived. The functional result has been very satisfactory in these 10 cases; in all there has been voluntary micturition five or six times in twenty-four hours, the urine has remained clear, and ascending infection has not occurred.

J. W. Thomson Walker.

BLADDER, GROWTHS OF.—For the purpose of prognosis, growths of the bladder may be divided into two groups: (1) *Papillomata or villous growths*; (2) *Malignant growths*. It is true that there are tumours which possess the characters of both of these groups, and it is admitted that papilloma of the bladder displays features that differ from simple growths elsewhere. The grouping is, nevertheless, a practical one, and will be used, while recognizing the pathological fallacies which underlie it.

A number of varieties of growths, such as myoma, fibroma, and myxoma, are found, but so rarely that they do not merit special discussion.

1. Papilloma.—Papillomata are generally regarded as benign growths. In the

bladder, however, they show certain characters which give them a place somewhere between the well-defined benign and the clearly-recognized malignant growths. They have a very pronounced tendency to become multiple; the distribution of smaller papillomata around large growths, or of papillomata occurring at opposing points of contact of the bladder wall, suggest a special tendency to implantation; there is also a very pronounced tendency to recurrence of the tumours. A certain number of papillomatous growths, after retaining their benign characters for many years, infiltrate the submucous and muscular layers of the bladder wall, and show signs of true malignancy.

In view of these facts, some authorities, such as Albarran and Imbert, and Brongersma, regard all papillomata of the bladder as malignant. The present writer looks upon these growths as pre-cancerous, and as occupying a position in regard to malignancy somewhat similar to that of leucoplakia of the tongue.

The following are important points on which to base an estimate of the prognosis in a case of papilloma of the bladder.

a. The Duration and Complications.—The history of a case of papilloma may extend over many years, an operation then having been performed. A duration of ten or fifteen years has frequently been recorded, and Albarran collected cases with a history of symptoms lasting twelve, fourteen, and thirty years.

Certain complications may lead to a fatal result, and thus increase the gravity of the prognosis.

Excessive hæmorrhage occurs in some papillomata. As a rule, the attacks of hæmaturia are at first separated by long intervals (six months, or even one or several years); but gradually the intervals become shorter, and the attacks more prolonged and more severe. Profound anæmia may ensue, and indirectly lead to a fatal result. A serious complication of severe hæmorrhage is the formation of masses of clot in the bladder. Retention of urine results from the inability of the bladder to expel the clots. The danger of infecting this clot-filled bladder by passing a catheter is extreme; and if infection take place, severe cystitis and ascending pyelonephritis follow, and a fatal result is certain.

Obstruction of the outlet of the bladder occurs when masses of papillomata are clustered round the internal meatus, or when a single papilloma with a long pedicle acts as a ball-valve. In such cases the bladder is trabeculated and sacculated, and the ureters and pelves of the kidneys are dilated. Infection of the bladder is specially liable to occur in such cases, and death from uræmia is a common result of injudicious instrumentation or of radical operation.

Infection of the bladder in papilloma rarely takes place spontaneously, and in this, papilloma differs from infiltrating growths of the bladder. The passage of an infected catheter or cystoscope is the usual cause. As already noted, it is specially liable to occur where obstruction is a feature of the case.

The prognosis in a case of infected papillomatous bladder is very grave, since the infection is difficult to overcome; and ascending pyelonephritis is a frequent and very fatal sequence.

Exhaustion accounts for a large proportion of deaths. It results from constant irritation and broken rest, from septic absorption, and from frequently recurring hæmorrhage.

b. The Results of Operation.—The best results of operation are obtained in early cases where the growth is small, single, or in moderate numbers, the bladder aseptic, and the kidneys healthy.

In order to operate in this early stage, it is absolutely necessary that those engaged in general practice should thoroughly grasp the grave significance of hæmaturia—the cardinal symptom of papilloma. It is unfortunate that the hæmaturia of vesical papilloma is unaccompanied by any other symptom, and that it is intermittent in character, with, at first, prolonged intervals between the attacks. As a consequence, the patient, and not uncommonly his medical attendant also, looks upon the disappearance of the hæmaturia as indicating the cure of the complaint.

It cannot be too frequently or too strongly urged that an attack of hæmaturia, however transient, is a matter of grave significance, and that the source of the hæmaturia must be traced and a definite diagnosis made; and that for this purpose, in the great majority of cases, the cystoscope is necessary. The absence in the urine of cells

derived from the surface of the papilloma, and the absence or presence of cells derived from the kidneys or bladder, are insufficient data on which to base a diagnosis, however definite the clinical pathologist's report or opinion may be.

The prognosis for recurrence and for malignant transformation of the growth becomes graver as the duration of the papilloma is more prolonged.

The following results of operation on papilloma of the bladder may be noted :—

Endovesical operations by means of the operation cystoscope have been used by some surgeons. Their use is limited to the most favourable types of bladder papilloma, when the bladder is tolerant of intravesical manipulation, and the papilloma is not too large or too extensive. Nitze recorded 101 intravesical operations for papilloma, performed before 1902; of these, 71 cases remained without recurrence, there were 18 recurrences, and 12 cases could not be followed.

High-frequency cauterization (fulguration) of papilloma is now the method used in all suitable cases. The internal electrode is applied direct to the papilloma through a catheterizing cystoscope, the external electrode being applied to the abdomen or thigh, and the current being obtained from a high-frequency apparatus connected with the main. The cases suitable for this treatment are all small papillomata. Unsuitable cases are most multiple papillomata, large papillomata, and papillomata where there is a suspicion of malignant infiltration of the bladder wall. Papillomata surrounding the internal meatus are difficult to reach, but are not otherwise unsuitable for this method. A sensitive bladder, the presence of cystitis, and a nervous patient may render this method impossible. The number of sittings vary with the size and number of the growths and the tolerance of the patient. The patient is kept under observation at intervals of some months for one or two years after the papillomata have been destroyed.

This method is of great use after the removal of papillomata by open operation. The bladder is examined with the cystoscope at intervals of three months at first, and later of six or twelve months, and on the first appearance of recurrence the small papillomatous end is destroyed. This method has greatly improved the prognosis in operative cases, and by its means the number of secondary open operations has considerably diminished. Further, this treatment being applied in the earliest stage of a recurrence, the gravity of the procedure is much less. Removal by suprapubic operation is preferred in all cases unsuitable for fulguration.

Rafin collected 265 cases, of which 21 died, a mortality of 8 per cent. He found, however, that the mortality improved considerably in recent cases; thus, in the latest 156 cases, the death-rate was 3·8 per cent. An examination by this author of the remote results in 115 cases, showed 33 recurrences, or 28 per cent; there were 82 cases without recurrence, at periods varying from one to five years; in 18 cases there was no recurrence after a period of over three years.

Recurrences of papilloma take place after considerable intervals, such as four, six, seven, or eight years after operation. According to Legueu, the patient can never consider himself completely free from the possibility of recurrence.

As a rule, recurrence after operation in papilloma takes the form of multiple growths, at first of small size.

A certain number of recurrent growths, after operation for papilloma, have proved to be malignant. Burckhardt found that of 15 cases operated on for papilloma, and in which the growth recurred, the recurrent growth was malignant in 3.

2. Malignant Growths.—The outlook in malignant growths of the bladder, when no radical operation is undertaken, is a certainly fatal one. The duration of the disease varies considerably. There are a number of cases where symptoms, such as hæmaturia, have existed for some years—as long as five or even eight years—and then a rapid advance takes place, the growth infiltrates widely, forming metastases, and death quickly supervenes. In such cases the total duration of symptoms, up to the time of death, may reach eight to ten years. The most common type shows a steady advance of symptoms, which terminate fatally in from one and a half to two years.

Experience has shown that malignant growths are unsuitable for treatment by fulguration; an increase in the rate of growth is frequently observed when this method is used.

Malignant growths of the bladder are, in their earlier stages, admirably suited for

radical operation in proper hands. Spread to lymphatic glands, and metastatic deposits in distant parts, take place only in the latest stage; and the prospect of cure by a well-timed and properly-planned operation is, compared with malignant growths of other internal organs, extremely good.

The following factors directly influence the prognosis by their effect on the result of operation:—

a. The Nature of the Growth.—The different varieties of malignant growths of the bladder vary widely in their rapidity of growth and tendency to recurrence after operation. The most chronic in its growth, and the slowest to recur, is the epitheliomatous ulcer or canceroid, which forms a depressed ulcer, and has the structure of a squamous epithelioma. The nodular malignant growth varies considerably in its size, and also in the rapidity of its growth, and recurrence after removal; histologically, these growths show either the characters of a spheroidal-celled carcinoma, or they are formed of papillomatous tissues so closely welded together as to be almost unrecognizable. Some malignant papillomatous tumours show rapid and luxuriant growth, and very rapid recurrence after operation.

b. The Extent of the Growth.—Extension of a bladder growth may be intravesical, intramural, perivesical, or there may be glandular involvement. The intravesical extension is gauged by means of the cystoscope. A malignant growth of very large size is seldom worth while operating upon with the view to radical cure, as it will certainly have passed beyond the limits of the bladder and formed deposits elsewhere. The particular size of the growth which experience has taught me is suitable for partial resection of the bladder does not exceed a walnut or the area of a two-shilling piece as seen by the cystoscope. The intramural spread is almost always more extensive than the intravesical extent would suggest; it is best gauged by the finger, after opening the bladder. The perivesical spread can only be estimated at operation. Extensive intramural spread, and perivesical encroachment of the growth, render the case unsuitable for partial resection of the bladder wall, and therefore affect adversely the prognosis.

c. The Position of the Growth.—A growth situated at or near the apex of the bladder is in the ideal position for resection. As the position of the growth, in different cases, approaches the base, it becomes less and less suitable for resection. The reason for this is not due to any increasing malignancy in growths at the lower part of the bladder but to closer relation to the ureters, the trigone, prostate, and urethra.

If a clear exposure of the lower part of the tumour can be obtained, and the surgeon does not allow himself to be hampered by an attempt to avoid the ureters or trigone, the middle and even the lower parts of the bladder are still suitable for resection; the lower part of the ureter being, if necessary, removed with the growth, and the stump implanted in the bladder wound.

When the growth has encroached upon the trigone, or lies in close proximity to the urethral orifice, resection should not be performed. In 3 out of 5 of my cases of recurrence the growth was situated in close relation to the trigone and ureters, and in 2 of these the size was so considerable as to interfere with the manipulation at the lower part of the incision.

d. The Condition of the Bladder and Kidneys.—The greatest danger at the time of the operation, and after recovery from it, is sepsis. Malignant growths of the bladder have a special tendency to spontaneous infection. Over 40 per cent of all the cases that have come under my observation have presented the clinical picture of spontaneous cystitis, and were referred to me without a suspicion that a malignant growth underlay the cystitis. In 2 per cent of the cases the cystitis was so severe and persistent that operation had to be refused.

Cystitis is not only a danger to the patient, from the pelvic cellulitis and other septic complications that may follow operation, but it gravely hampers the work of the surgeon, rendering the bladder cavity much smaller, and the bladder wall difficult to manipulate.

Ascending pyelonephritis may be present before the operation, and accounts for some part of the operation mortality. It is a serious danger during the early part of convalescence when the case is already septic, and may cause death many months or some years after recovery from the operation. It is not more liable to occur when a

ureter has been transplanted : in 10 of the author's cases, resection of the ureter and implantation in the wound was necessary ; in none of these did pyelonephritis develop.

RESULTS OF OPERATION FOR MALIGNANT GROWTHS.—

Palliative Operations.—These occasionally become necessary in order to treat symptoms. Apart from the relief given in this way, no permanent benefit is obtained. The patients survive from three to nine months, or, less frequently, a year.

Removal of the Tumour.—Removal only, without any attempt to remove the tissues round the tumour, does not appear to prolong life. Rafin collected 57 cases, with 8 deaths, or 14 per cent. Of the 49 survivals, only 38 were followed. The most part were dead, or suffering from recurrence, within a year ; 4 were dead of recurrence in one and a half, two and a half, or nine years ; 6 had not shown recurrence after periods of one, one and a quarter, two, four, and four and a half years.

Resection of the Bladder Wall.—

i. *Operation-mortality.*—Rafin collected 96 cases, of which 21 died, a mortality of 21·8 per cent. Rovsing collected 16 cases, with 3 deaths, a mortality of 18·7 per cent.

The following personal statistics may be noted :—

Operator	Cases	Deaths	Mortality per cent
Brongersma - -	36	5	14
Heresco - -	4	1	25
Zuckerkancl - -	8	0	0
Thomson Walker -	30	3	10

ii. *End-results.*—In 96 cases collected by Rafin, 75 survived the operation, but in only 52 was the late result known. Of these, 31 were followed till recurrence appeared, or death supervened ; this occurred in six months in 13 cases, twelve months in 11 cases, in the second year in 1 case, after three years in 2 cases, after four years in 2 cases. There were 21 cases without recurrence. Of these, 12 were followed for less than two years, while 9 were followed two years or over ; 4 two years, 1 three years, 1 three and a quarter years, 1 four years, 1 five years, and 1 six years.

In Rovsing's collected cases, 13 survived operation. Of these, 4 cases died of recurrence from four and a half to nineteen months after operation, and 1 died of cerebral tumour. The following cases are known to have survived : 2 one year, 1 seventeen months, 2 three years, 1 six years.

Brongersma gives the following results in his cases : 9 cases died from recurrence or metastases under two years, 1 died some months after operation from pneumonia, 2 were still under treatment, 18 showed neither recurrence nor metastases at periods varying from some months to seven years.

Kümmel reports that of 47 cases of bladder resection for malignant growth, 10 are well after six and a half, eight, fifteen, and sixteen years, and 1 died of recurrence ten years after the operation.

In 25 cases of resection by the author in which late information was obtained, there were 3 deaths from ascending pyelonephritis, and 6 recurrences, one of which was re-operated, and was well four years after the second operation. In 17 cases the patients were alive and without recurrence, as follows : six months after operation in 6 cases ; twelve months in 3 ; eighteen months in 6 ; two years in 1 ; and four and a half years in 1. (Statistics, March, 1911.)

Total Extirpation of the Bladder (Cystectomy).—Of 39 cases collected from the literature, death occurred after the operation in 18, a mortality of 46·1 per cent. Only 10 cases could be traced, and in only 2 of these was the period after the operation longer than fifteen months ; 1 was well five years afterwards (Hogge), and 1 sixteen years (Pawlik). Later statistics give an even higher mortality. Verhoogen and de Graeuwé collected 59 cases of total cystectomy, with an operation mortality of 52·7 per cent. Of the 27 cases that survived the operation, 6 died in the first year, 7 died before the third year, and only 2 survived more than three years. Cystectomy must, at the present time, be looked upon as a desperate measure which holds out little, if any, prospect of a cure.

J. W. Thomson Walker.

BLADDER, INJURIES OF.—(See ABDOMINAL INJURIES ; GUNSHOT WOUNDS.)

BLADDER, TUBERCULOSIS OF.—It is well recognized to-day that tuberculosis of the bladder is never, or only in the very rarest cases, primary, and that it results from extension of tuberculous infection from the kidney by way of the ureter, or the prostate or seminal vesicles. This being the case, the prognosis depends largely on that of tuberculosis of the kidney or genital organs ; and to these the reader is referred. (See KIDNEY, TUBERCULOSIS OF ; EPIDIDYMITIS, TUBERCULOUS.)

There are, however, some points that may suitably be discussed here.

1. The Course of Untreated or Unsuccessfully Treated Vesical Tuberculosis.—The course of tuberculous cystitis is slowly progressive, with periods of improvement and periods of relapse, dependent partly upon changes of diet and climate. At the commencement there may be a period of acute cystitis which subsides, a slight subacute cystitis persisting. More frequently, however, the onset is insidious, and the progress very gradual. After some years, the continual calls to micturate become very distressing, and the patient is worn out from loss of sleep. If septic complications are avoided, death takes place after some years from renal failure due to bilateral renal tuberculosis. More often there are septic complications, caused, almost invariably, by infection introduced by septic catheterization, or after drainage of the bladder by cystotomy. The condition of the patient, when this occurs, is distressing. There is constant desire to micturate, unsatisfied by the passage, with pain and scalding, of a few drops of urine every ten or fifteen minutes. The frequency and irritation continue day and night. During the day some method of collection of the urine becomes necessary, owing to the active incontinence which develops, and a rubber urinal is worn ; during the night the rest is broken by the constant calls, and bed-wetting is frequent. Secondary phosphatic calculi form in the bladder, and add to the pain and distress. Eventually, exhaustion combined with septic absorption bring about a fatal result, or ascending septic pyelonephritis may cut short the course of the disease.

2. The Origin of the Tuberculous Infection.—Where tuberculous cystitis is secondary to renal tuberculosis, the prognosis varies at different stages of the disease. In unilateral renal tuberculosis, tuberculous cystitis affects the prognosis but little. The removal of the affected kidney is followed in most cases by a disappearance of the vesical infection, and the result is hastened by a course of tuberculin. It is a peculiarity of tuberculous cystitis, however, that even when the tuberculous infection has been quite cured, some increase in the frequency of micturition remains. Another point of interest in regard to these cases is that tuberculous ulceration of the bladder may be present, demonstrated by the cystoscope, and yet the urine be absolutely clear to the naked eye.

In the later stages of renal tuberculosis, tuberculous cystitis is a serious complication, from the constant irritation and loss of sleep that it produces, and especially from the danger of sepsis and ascending pyelonephritis.

In tuberculous cystitis secondary to tubercle of the prostate and seminal vesicles, the prognosis is not so good as in the early stage of renal tubercle. The results of treatment of the disease of the prostate and seminal vesicles by operation are not satisfactory, and septic complications are very frequent. Some cases react well to tuberculin, but in many the improvement is only partial and temporary.

3. The Results of Treatment.—Removal of the source of the tuberculous infection, as for instance the kidney, is the basis of treatment. Where this is impossible, as in bilateral renal tuberculosis, or when it has failed, as in persistent tuberculous cystitis after nephrectomy for unilateral renal tuberculosis, more direct measures are necessary.

Tuberculin treatment is the most successful method, and the most favourable cases are those where the original focus of tubercle has already been removed. Where the infection is mixed, vaccines should be used alternatively with the tuberculin injections.

Local treatment by washing, or by instillation of various drugs, is highly recommended by some authorities. The best known of these methods is the repeated instillation of 5 per cent carbolic acid recommended by Rovsing. Good results are claimed for this treatment, but exact figures are not available. With all these methods there is a danger of introducing sepsis and producing a mixed infection.

J. W. Thomson Walker.

BONE TUMOURS.—We have to consider the following growths of bone: osteoma, chondroma, sarcoma, carcinoma, multiple myeloma, 'thyroid cancer', and cysts. Epulis is discussed elsewhere (*see* JAWS, TUMOURS OF).

Several of the above can be dismissed with a few words.

Osteoma.—Ivory osteoma, usually arising about the orbit or on the jaw, is a progressive tumour of extremely slow but steady growth, and does no harm unless it presses on important structures.

Cancellous osteomata and exostoses are usually capped by cartilage which ossifies at about twenty-one to twenty-four, when growth of the skeleton ceases, so that the exostosis attains its maximum at that age. Large sessile cancellous osteomata may, however, go on growing.

Complete removal is not followed by recurrence.

Chondroma.—A pure chondroma, such as may be found on the fingers of young adults, grows slowly but progressively, is not dangerous to life, and does not recur after removal.

Large, rapidly-growing cartilaginous tumours on a bone are usually to be classed with the periosteal sarcomata undergoing degeneration, and are very malignant.

Myeloid Sarcoma.—By this we mean a very vascular, usually deep-red, central tumour expanding the bone, containing a great number of giant cells under the microscope. It must be remembered that a central tumour of bone is not necessarily myeloid; it may be a malignant sarcoma, but this is uncommon. The older literature, including much of that utilized in Butlin's *Operative Surgery of Malignant Disease*, is quite unreliable in its description of the exact nature of the growth. He collected from the literature the following cases of 'central sarcoma':—

Humerus.—10 cases; 3 died of recurrence or metastasis (two of which were myeloid); 5 well, one to three years; 2 well, over three years. In most of these, Berger's amputation was performed.

Radius and Ulna.—10 cases: 1 died of recurrence (probably not myeloid); 3 well, one to three years; 6 well, over three years.

Femur.—14 cases: 5 died of metastasis (3 of these were myeloid); 2 recurred *in situ*; 2 were well one to three years later; 5 were well over three years. Nearly all these were treated by amputation.

Tibia and Fibula.—20 cases: 2 died of metastasis or recurrence (round-celled sarcoma, not myeloid); 9 well from one to three years; 9 well over three years. Here again, nearly all were amputated.

It will be observed, therefore, that in five cases myeloid gave rise to fatal metastases, but that 23 were well one to three years after, and a further 22 were well over three years.

Coming to more modern investigation, we find that there is a general consensus of opinion that myeloid is practically an innocent tumour, and it is very unusual for metastasis to occur when the diagnosis has been made by a reliable microscopist. The writer knows of one recent case in which fatal secondaries appeared in the lung.

On the other hand, Bloodgood reports that 18 cases seen by himself are all alive and well; he added to this from the literature, and finds that of 26 treated by curetting out, 5 recurred, but none formed secondaries; the other 21 were cured. Of 22 resected, 1 recurred and was amputated; the rest did well. Eve reports 7 cases treated at the London Hospital by amputation, resection, or, in one case, scraping; all were well from one and a half to ten years after.

Eight cases treated in Bristol by resection or scraping out have all done well, except that local recurrence took place in two cases scraped out.

We may conclude, therefore, that the risk of metastasis in the lungs exists, but is quite small, that inadequate local operations may be followed by recurrence *in situ*, but that almost all cases can be cured by an adequate operation. Amputation is only occasionally necessary, as, for instance, if the bony shell over the growth is very thin, and so great a length would have to be resected as to make the limb useless.

The operation mortality quoted by Butlin relates to ancient surgery; nowadays the risks are very small, probably not more than 1 or 2 per cent.

There is a variety of central growth containing giant cells called *telangiectatic sarcoma*

by Ewing and American pathologists, which is often very malignant. It affects the same bony sites as a true myeloid, but may be distinguished by its early tendency to perforate the shaft and invade the muscles, and it has some power to stimulate the formation of new bone, whereas a myeloid merely expands and thins the shaft. Telangiectatic sarcoma is very vascular and may pulsate, or form a bone aneurysm. Microscopically, the more malignant type betrays its character by the active appearance of the stroma cells, other than the giant cells, that compose it. In all probability cases of so-called giant-celled sarcoma that have formed metastases really belonged to the telangiectatic group.

Periosteal Sarcoma.—It is difficult to obtain accurate accounts of the prognosis of this disease from the literature, because so many statistics are hopelessly vitiated by the inclusion of cases of myeloid, or what is described as ‘mixed round or spindle cells and giant cells,’ which usually means myeloid. When this fallacy is eliminated, it becomes difficult to find cases of cure in patients with a genuine round- or spindle-celled sarcoma. The flat bones give better results than the long bones.

Kocher could only collect 15 instances of cure of periosteal sarcoma of the long bones, after amputation, in 1906. The more favourable statistics of Wyeth, Bergmann, and the Tübingen clinic all include endosteal growths.

Alexis Thomson records 5 periosteal sarcomas of the femur and 2 of the humerus treated by amputation (Berger’s in the latter cases), but only one remained well, a femur patient being alive two and a half years after. Nancrede published, in 1909, the end-results of 65 cases of excision of the *scapula* for sarcoma. They were as follows: 10 cases insufficiently followed; 35 cases died within two years; 7 cases well over four years. Death usually took place within a year (26 cases). In one case recurrence was as late as five years afterwards. The writer has seen an unpublished case of mixed-celled sarcoma well more than three years after removal of the blade of the scapula. The operation mortality in Nancrede’s series was about 10 per cent.

Sarcoma of the Humerus is terribly malignant. The mortality of Berger’s operation since 1887 is about 6 per cent (Chavasse, Barling, Dent, quoted by Butlin). The only case of cure mentioned by Butlin in which the diagnosis was microscopically confirmed, was a growth of the lower end of the humerus amputated in Göttingen, and well at least eight years afterwards.

Sarcoma of the Femur is common, and is very malignant. The mortality of amputation at the hip-joint was considered to be about 12 per cent, but is probably less at the present time. In Butlin’s series of 68 cases, only 2 lived for three years; 1 of these had had a growth for seven years, and it is not certain that the other was a periosteal sarcoma.

A case treated by local removal at the Bristol Royal Infirmary in 1910, associated with repeated fractures in 1904, 1906, and 1910, was seen apparently cured in September, 1913. The microscopical report, by a front-rank pathologist, was fibrosarcoma.

Sarcoma of the Tibia or Fibula.—In a series of 35 cases, Butlin found 1 alive and well after seven years, and 4 well between one and two years. The patient apparently cured had had the growth for eight years before operation. A case at the Bristol Royal Infirmary treated by amputation was quite well when last seen, fifteen months later.

Recurrence is not usual in the stump, but the patient dies of metastases in the chest, with groin glands also invaded in many cases.

Sarcoma of the Skull.—Although of course the great majority of these cases are very unfavourable and proceed to a fatal termination in six to twelve months, with pressure on the brain, or an external fungating swelling, there are a few instances in which the growth appears to be less malignant in nature. One such, removed at the Bristol Royal Infirmary in 1904, recurred in 1908, and was then the size of a hen’s egg; it was again removed, and four years later the patient was known to be well, and is almost certainly still alive, though out of England. The microscopical diagnosis was fibrosarcoma. In another case seen by the writer, the growth, a spindle-celled sarcoma, was stationary for five years (further history not known) after injections of Coley’s fluid. Jacobson and Morris both record patients living for five or six years after the first appearance of the growth. Bergmann claims to have cured 5 (how long followed is not stated) out of 17 cases operated on. Some tumours of the skull are myeloid in nature, and may yield better results.

Sarcoma and Carcinoma of the Jaws are discussed elsewhere (see JAWS, TUMOURS OF).

It will be gathered from the data given that sarcoma of the long bones is almost never cured by amputation, except when it is obviously very chronic, but that in the flat bones there is some slight prospect of cure.

The results in children are much the same as in adults. Rawling has collected cases in the literature of bone sarcoma affecting children under nine years. Of 59 cases, only 1, a patient with congenital sarcoma of the scapula treated by local removal at five months, was followed up and found to be cured several years after.

Two other methods of treatment call for some consideration.

COLEY'S FLUID.—There are cases on record, one of which (a sarcoma of the orbit) the writer has seen, where a sarcoma has disappeared after an attack of erysipelas, and Coley has steadfastly maintained the value of his mixed toxins of erysipelas and *Bacillus prodigiosus* as a curative agency in sarcoma.

Although the treatment was at first adversely reported on by an American surgical committee, Coley subsequently convinced its members and won them over to his side. The results in England are not so favourable as in America, but the writer has seen a patient with sarcoma of the temporal region, explored, microscoped, and found inoperable, cured and followed for many years after the treatment; and a lad with sarcoma of the foot similarly treated has remained *in statu quo* for more than three years. There have been, of course, a number of failures besides.

Coley claims to have cured, and followed up for three or more years, 4 cases of periosteal sarcoma of the femur and one of the tibia; all except 1 femur case were also amputated. This patient eventually died, more than ten years after, of a mixed epithelioma-sarcoma in the scar of an *x*-ray burn. Eve also reports a case of sarcoma of the femur amputated and treated by Coley's fluid, well two and a half years afterwards, but in 10 other cases the fluid did no good. In other situations (muscle, etc.), the injections are said to have cured over 100 cases of sarcoma, followed three years or more afterwards.

Personally, I do not think amputation of the arm, or of the leg above the site of election, worth performing in cases of sarcoma of the long bones. I prefer Coley's fluid as less mutilating and more successful.

RADIUM.—In one case known to the writer, radium treatment has arrested the growth of a sarcoma of the femur, verified by the microscope, for three years, and the patient obtained a commission in the Army; but it is too soon yet to speak of radium cures.

Carcinoma of Bone.—This is always secondary, usually to cancer of the breast, and in the humerus often leads to spontaneous fracture, and in the spine to great pain and pressure on the cord. The prognosis depends on whether there is evidence of growth in the lung or abdomen. Cancer of the bones may go on for months or years, but when the lung is obviously involved, it is fairly safe to say that the patient will not live six months, probably much less.

Multiple Myeloma, Myelopathic Albumosuria, Kahler's Disease.—This disease, characterized by endosteal swellings in various bones, notably the ribs, sternum, and vertebræ, and a peculiar albumose called Bence-Jones' protein in the urine, is usually very malignant and runs a rapid course, killing the patient in about two years. Recently benzol has been given with some success in cases of this disease.

The writer has seen a case, however, under the care of Mr. Hey Groves, in which the disease was arrested naturally, and the patient was living and well after many years, but severely crippled by badly united spontaneous fractures.

'Thyroid Cancer.'—In this curious condition a tumour appears on the skull or sternum, often pulsating, having the structure of thyroid tissue, and associated with an enlarged or cancerous thyroid. The English cases all died, but Goebel relates some successful removals of the growth in bone.

Bone Cysts.—Cysts of bone are either of the nature of osteitis fibrosa which has developed central cystic cavities, or hydatid cysts, usually in the lumbar vertebræ or hip-bone.

Simple bone cysts of the former variety reach a certain size and then remain stationary throughout life, giving rise sometimes to spontaneous fractures. Bloodgood reports the

results of operation on 38 cases treated by curetting; 2 died of hæmorrhage, in another amputation was necessary for the same reason, and the other 35 did well.

Hydatid cysts of the spine are apt to enlarge progressively and press on the cord, but the results of operation are satisfactory.

REFERENCES.—Butlin, *Operative Surgery of Malignant Disease*, 2nd ed., 1900; Bloodgood, *Ann. of Surg.* 1910, lii, 145; *Ibid.* 1912, lvi, 210; Eve, *Lancet*, 1912, ii, 1355; Alexis Thomson, *Edin. Med. Jour.* 1907, lxiv, 423; Nancrede, *Ann. of Surg.* 1909, l, 1; Rawling, *Lancet*, 1907, i, 352; Coley, *Ann. of Surg.* 1907, xlv, 321; Coley, *Proc. Roy. Soc. Med.* 1910 (*Surg. Sect.*), 1; Goebel, *Deuts. Zeil. f. Chir.* 1898; Groves, *Ann. of Surg.* 1913, lvii, 163.

A. Rendle Short.

BRACHIAL PALSY.—(See NERVE INJURIES.)

BRAIN, SURGERY OF THE.—(See GUNSHOT WOUNDS; HEAD INJURIES; CEREBRAL TUMOUR; INTRACRANIAL COMPLICATIONS OF EAR DISEASE.)

BREAST, CANCER OF.

Prognosis apart from Operation.—To foretell the duration of life in a patient with breast cancer is one of the most difficult problems which can confront the medical man. Indeed, in many cases no answer whatever can be given. This is not surprising when it is borne in mind that in the worst cases the disease may run its course in three months, while at the other end of the scale the patient may live for thirty years or more with a cancer which during the whole of that time shows some evidences of activity. But there are certain varieties of breast cancer in which a definite prognosis is possible.

Acute Breast Cancer.—If the whole breast is involved in a large swelling which is everywhere adherent to the skin, if also the breast is fixed to the deep fascia, if enlarged hard glands are present in the axilla, and more especially if the skin over the tumour shows a red blush, it can be stated almost with certainty that the patient will be dead in six months, and that no operation is of the least use.

Atrophic Scirrhus.—In certain cases in old people the nipple may be slightly indrawn, or a definite local depression may make its appearance at some point in the skin over the breast, while the whole breast becomes somewhat shrunken; no tumour can be felt in the breast, nor are the glands enlarged. Such a case is an example of atrophic scirrhus in its extreme form, and it is possible to assert that the patient will probably go on for a number of years without pain or trouble of any kind. Ultimately, however, and especially if the breast is too freely examined or massaged, it is probable that a tumour will develop, the glands will become enlarged, and the case slowly run the ordinary course of breast cancer. But if, as frequently happens, the patient is already old when the tumour is discovered, the probabilities are that she will die of some other condition.

In the less typical forms of atrophic scirrhus, a small hard lump is present which changes its character but little for extensive periods of time. In such cases a prognosis of some years' duration of life, say up to ten, may be given with probable approach to accuracy.

Carcinoma during Lactation.—If a breast cancer develops during lactation, although it may make little progress so long as suckling is continued, it will probably grow rapidly when the milk ceases to be secreted, and the prognosis is a bad one.

Mastitic form of Carcinoma.—As a rule, cancer of the breast forms a rounded lump which bears no relation to the anatomical outlines of the lobes of the breast, but there are certain cases where the cancer commences throughout the substance of one or more lobes. Such cases generally originate as a chronic mastitis. The tumour formed resembles, in its sector-shape, the thickenings of chronic mastitis; that is to say, it marks out the limitations of one lobe or a group of lobes. The induration is, however, much more definite and tumour-like than is usually the case in chronic mastitis, and the axillary glands will probably be large and hard, but not tender. A diagnosis may be difficult, but this question does not now concern us. It must be recognized that this form of carcinoma, perhaps owing to its multicentric or diffuse origin, is of particularly bad prognosis, and that recurrence is likely to take place within a year after operation.

Duct Carcinoma.—The recent work of Sir Lenthal Cheate has shown that duct carcinoma is much commoner than has been supposed, and that it is probably more frequent than carcinoma originating in the acini; but the typical form of duct carcinoma

of the large ducts, which originates beneath the nipple in women of advanced years without causing retraction of the nipple, is a comparatively benign tumour and runs a somewhat slow course. The prognosis after operation is distinctly good.

Ordinary Scirrhus.—It is only in the exceptional forms of breast cancer that a definite opinion as to duration of life can be expressed. In the ordinary scirrhus of the breast not operated upon, cases which are apparently similar may live for varying periods. The younger, stouter, and more healthy-looking the patient, the shorter is life likely to be if no operation is performed. So long as the disease confines itself to the parietes of the body, and does not involve the visceral cavities, duration of life remains uncertain; but from my experience I can state with some confidence that when there are visceral deposits, whether in the chest, abdomen, or head, the patient's life is unlikely to be prolonged more than a year. Many die within six months after the first onset of visceral deposit. The process of permeation which carries breast cancer from its point of origin to one or other of the great visceral cavities is slow in operation, and probably subject to periods of alternate quiescence and activity. But once a serous cavity is reached, the cancer is in a far-spreading land of plenty. Its cells accordingly proliferate actively and soon attack vital organs.

Causes of Death in Untreated Breast Cancer.—Although dissemination is the rule, a cancer of the breast may run its course without producing secondary deposits. In these cases the patient may die from exhaustion, hæmorrhage, or sepsis.

When dissemination occurs, death often takes place from serous effusions caused by lymphatic obstruction, itself the result of widespread permeation. It is in this way that ascites, pleural effusions, and pericardial effusion are produced. Œdema of the lung, simulating a low form of pneumonia, is probably caused in the same way. Less frequently paraplegia due to spinal deposits, or cerebral growths, may be the cause of death. Hæmorrhage from the primary growth may be directly fatal. The average duration of life in untreated breast cancer is stated by Campiche and Lazarus Barlow to be about four years.

Prognosis as regards Recovery from Operation.—Although the modern operation for breast cancer is apparently a severe one, it does not produce marked shock if care is taken, especially in regard to preventing chill during the operation. Even old persons stand it well. Nevertheless, in hospital practice there is a definite death-rate, mainly due to the risk of infection arising from the collection of mixed surgical cases in one ward. This risk may be placed at from 1 to 2 per cent. My personal experience in hospital practice includes the loss of cases from influenza (at the time of an epidemic), erysipelas, bronchopneumonia, and pulmonary embolism. In a nursing home or private house, on the other hand, I have never lost a case, a fact which appears to show convincingly that the belief that a hospital is the safest place for operation is erroneous.

Prognosis as regards Recurrence after Operation.—It cannot be too strongly emphasized that the prognosis after an operation for breast cancer is largely dependent upon the thoroughness with which the operation is performed. Axillary recurrence, which is hardly ever seen after a thorough operation, is common after the inadequate ones which are the far too frequent handiwork of the 'occasional' surgeon.

As regards operation statistics, it may be doubted whether they are of great value, since they depend so largely upon the stage at which the case is first seen, upon the mode of selection of cases regarded as suitable for operation, and upon the thoroughness of the operation.

In my own series of cases, perhaps an unduly large proportion have been advanced ones; moreover, no case, however late, has been refused operation if there seemed to be any reasonable prospect of benefit. Of the cases I have been able to trace, 48 per cent have remained free from recurrence for three years and upwards. It is probable that further improvement on these results must be sought in the better education of the public to a recognition of the early signs of cancer, and in improved radiological treatment. I am hopeful that the use of radium at the time of the primary operation in the situations out of operative reach where recurrence is especially likely, will bring a definite improvement. I shall refer to this method again. It would not be fair to attempt to improve results by a more rigid selection of cases, for the practice of operation for statistics is now rightly condemned by surgical opinion. Included in my series are two cases, which were

both absolutely inoperable by all ordinary rules, in which the patients were able to do full work for periods of five and two years respectively after the operation.

Amongst the cases of breast cancer operated on by Dr. Halsted and his associates in the Johns Hopkins Hospital and other hospitals in Baltimore, the cures reckoned five years after the operation are about 40 per cent. If, however, the cancer is seen in such an early stage that the diagnosis can only be made by an exploratory incision, and if the complete operation followed immediately on the exploratory incision, 80 per cent of the patients remained well after five years. According to Bloodgood, who gives these statistics, the outlook is entirely different if the radical operation is not carried out at the same sitting as the exploratory one. Should an interval elapse between these two procedures, Bloodgood states that the probability of the five-year cure is reduced from 80 per cent to about 13 per cent. The experience of Bloodgood in this respect is not in accordance with my own. I do not believe there is much danger in the separation by a short interval between the exploratory and the radical operation, although it is desirable to combine the two.

The most favourable indubitable statistics of the operation for breast cancer are those obtained by Professor W. R. Rodman, of Philadelphia, and brought forward by him at the London Clinical Congress of American Surgeons in August, 1914. These statistics refer to 50 private cases operated upon three or more years previously. Of this number, 13 are dead, 1 had a recurrence in the mediastinum after three years of apparent good health and was accordingly reckoned among the dead, and the remaining cases, constituting 72 per cent of the total, were well after three years. As Dr. Rodman says, these results could not be obtained in hospital practice. Private patients apply earlier, offer better resistance, and will keep under observation indefinitely, thus permitting a second operation if necessary. Several of his cases have been saved by second operation, a point in which his experience agrees with my own. Dr. Rodman adds that some of his cases were so early that a clinical diagnosis of cancer could not possibly be made until after histological examination. These results, which have not been equalled in this country, probably indicate that in the United States the public are better educated in regard to the danger of cancer, and, dreading operation less, seek advice in an early stage of the disease. The further improvement of English results depends upon the education of the public in this direction.

I may add that Dr. Rodman accepts my own conclusions as to the mode of dissemination of carcinoma, and that the operation he practises is in accordance with the conclusions of the permeation theory of dissemination.

Prognosis after Recurrence.—It is too much the custom to abandon hope and sit with folded hands when, after an operation for breast cancer, recurrence has declared itself. It is true that in such cases the ultimate outlook is generally bad; but if the recurrence is recognized promptly and treated vigorously, it may be possible to prolong the patient's life for at any rate some years.

The modern operation for cancer, followed up by a prophylactic course of x rays, has practically abolished the irregular recurrences beneath the flaps, and in the immediate neighbourhood of the scar, which were so frequently seen before the centrifugal spread of the disease in the lymphatic plexus of the deep fascia had been detected. Now that the nature of the process of permeation is understood, it is possible to avert such recurrences by properly 'centering' the operation on the point of origin of the growth, and by paying special attention to the removal of a maximal circular area of the deep fascia—an area of which the point of origin of the growth must always be the centre.

After a well-designed operation, recurrence, if it takes place, will usually be found in one of two places: either in the upper intercostal spaces—first, second, and third—originating from glands of the anterior mediastinum which were already infected at the time of the operation; or in the supraclavicular glands. Submammary, cutaneous and fascial, subclavian, or visceral recurrence may also occur.

Intercostal Recurrence.—The first variety of return may be described as intercostal recurrence. It is signalized by the appearance of fascial nodules, at first unadherent to the skin, at the inner ends of one or more of the intercostal spaces mentioned. In such cases further operation is useless. But though such cases are apparently hopeless, they have been treated successfully by several methods. Halsted has used the actual cautery

with success. I have employed for their treatment the method of secondary x rays, in which metallic particles injected into the tissues, and subsequently exposed to x rays, become themselves the source of secondary soft x rays. An injection of a suspension of bismuth carbonate is made at the edge of the sternum in the infected space or spaces, and the area is subsequently vigorously x -rayed. I have more than once seen the recurrence vanish under this treatment, which I began to use eight years ago; sometimes, on the other hand, the disease proceeds on its course unchecked. One of my patients with this apparently hopeless form of recurrence has now been well over seven years since the x -ray treatment commenced. The method of secondary x rays is not free from risk, and in two cases shortly after its use cerebral symptoms developed, perhaps as a result of bismuth emboli. For this reason, and also because radium is more effective, I have abandoned its use. It is probable that radium will become the agent of choice in the treatment of intercostal recurrence. A 50-mgrm. tube of radium is embedded in or under the nodule for a period varying up to twenty-four hours. Within a few weeks the nodule often completely disappears, and the disease may remain quiescent for several years at least. It is too early to say whether a permanent cure may result. The application of radium to the surface of the skin is a much less effective method, and cannot be recommended in these particular cases.

Supraclavicular Recurrence.—If the patient is seen at regular intervals subsequently to the primary operation, and is carefully examined, recurrence in the supraclavicular glands will be detected at a time when the glands are still freely movable and not of great size. The first sign of supraclavicular recurrence is often the appearance of a single hard gland deep in the lower and inner angle of the posterior triangle, overlying the subclavian artery. In this region the examination must be especially thorough, and it can best be made standing behind the patient, who is in a sitting position. For purposes of comparison the two sides should be palpated simultaneously. If the glands are mobile there can be no doubt whatever that the right treatment is operative; but it is useless to perform a limited form of operation restricted to the parts below the omohyoid. The whole of the posterior triangle must be cleared of its glands, from the mastoid process down to the sternoclavicular joint, and outwards as far as the edge of the trapezius. The tissues containing the glands should be removed in one piece. The operation required is an extensive one, and it is necessary to open the carotid sheath, and to carry the dissection down to the near neighbourhood of the thoracic duct, removing all the tissues between the sternomastoid and the scalenus anticus. The operation is not one which should be undertaken by the inexperienced. My experience shows that freedom for five years or more may be hoped for, and that almost always the patient will be freed from the terrible prospect of a mass of growth fixed to the brachial plexus and causing agonizing pain. If the disease returns, it is likely to do so in a painless form within the chest. It is advisable at the time of operation to introduce one or more tubes of radium beneath the flaps, for a period of twenty-four hours, with due precautions to prevent injury to the skin flaps.

The foregoing remarks apply to early supraclavicular recurrence. If the glands are large, and especially if they are fixed, an operation is rarely advisable, and if it is performed, local recurrence is very likely to take place. In this event the recurrence will be a diffuse one, and the patient's condition is rather aggravated than improved by the operation. If, however, the only fixed gland is the one at the lower and inner angle of the triangle, the case, though not hopeful, may still be regarded as operable. In one such case upon which I operated in an old lady, the patient is still free from recurrence seven years later.

Submammary Recurrence.—If after an operation nodules appear over a region corresponding to the area of contact of the breast with the chest wall, and if these nodules are adherent to the ribs and muscles but not to the skin, it may be inferred that at the time of the operation permeation had extended into the lymphatics of the intercostal muscles. Under these circumstances recurrence is of course inevitable, unless the prophylactic course of x rays is able to destroy the remaining cancerous foci. This form of recurrence, though unavoidable, is fortunately not common. It may be spoken of as submammary recurrence.

Cutaneous and Fascial Recurrence.—The form of recurrence which follows inadequate operation for breast cancer is usually that known as local recurrence, in which nodules

appear in or near the scar of the operation. If these nodules are cutaneous, i.e., fixed to the skin, they should be excised if they are near the scar, or treated by buried radium; but if they occur at the periphery of the field of operation, or are fixed to the deep fascia, they probably indicate inadequate removal of the deep fascia, with widespread and inoperable extension of the disease in that layer. Under these circumstances the only treatment is by penetrating x rays, and the ultimate outlook is a bad one.

Subclavian Recurrence.—When during an operation for breast cancer the subclavian glands are left behind, these glands are usually the seat of recurrence. This is a form which is extremely likely to occur in the practice of inexperienced operators. It can be prevented with almost absolute certainty by skilful and thorough operation. The subclavian glands are situated beneath the costocoracoid membrane, below the clavicle and above the pectoralis minor, at the extreme apex of the axilla. Recurrence in these glands is indicated by a lump deeply situated behind the pectoralis major and immediately below the clavicle. To this bone the lump may become adherent in the latest stage, simulating a deposit of cancer in the clavicle itself.

The prognosis in subclavian recurrence is a very grave one, though operation, if undertaken early, and followed by vigorous radiation, is not entirely hopeless, especially if it be combined with the use of radium.

Visceral Recurrence.—When signs of the return of the disease in the interior of the thorax or abdomen have made their appearance, it is possible to give a precise prognosis. Before the disease has reached the visceral cavities, a cautious man will often refuse to give any estimate of the duration of life; it may vary from a few months to twenty or thirty years. When the signs of visceral return are manifest, it is an almost invariable rule that the patient will die within a period not exceeding a year, and not usually exceeding six months. In such cases treatment is of no avail, though it has appeared to me that sometimes open-air methods on the lines of sanatorium treatment for phthisis have somewhat deferred the inevitable result.

Influence of X-ray Treatment on Prognosis.—

Prophylactic X Rays.—A course of prophylactic x rays subsequent to the operation for breast cancer should never be omitted. It is known that, at any rate in some cases, x rays may cause the atrophy and disappearance of large masses of cancer cells. How much more effective, therefore, they must be when applied to small undetectable groups of cancer cells which may possibly lurk in the tissues subsequent to an operation for breast cancer, especially since by the removal of the breast these microscopic groups are brought nearer to the surface instead of being protected by the whole thickness of the breast. But the value of x rays does not rest on *a priori* considerations. My own experience conclusively proves their value. In my series of cases, only four or five times has recurrence been observed in the skin or subcutaneous tissues; in all of these cases, with at most one exception, the patient for one reason or another had escaped the prophylactic course of x rays which I give to all my cases. The facts are rendered more striking when it is remembered how small a proportion the cases which escaped post-operative x -ray treatment bear to the total number of cases.

The value of x rays in the treatment of masses of cancer cells of macroscopic size is smaller, but an undoubted one; such masses are usually accompanied by wide-spreading microscopic ramifications of the disease, which may very probably have extended deeply, e.g., to the pleura, beyond the range of x rays. Consequently, though these nodules may shrink or disappear in such cases, x -ray treatment is usually only of temporary value.

Influence of Radium Treatment on Prognosis.—Speaking generally, and bearing in mind that radium has a purely local action of limited range, its field of usefulness in cancer of the breast is restricted by the fact that, except in early cases for which operation is the only trustworthy treatment, the area of extension of the disease is too large to be dealt with by the amount of radium ordinarily available. Owing to this feature of the disease, x rays in a majority of cases provide a more suitable form of radiation. But if a recurrence is strictly local and limited, as is often the case for instance in intercostal recurrence, radium possesses one great advantage over x rays. It is possible to introduce the source of radiation into the centre of, or in close proximity to, the focus of disease, and thus to give a dose of radiation which could never be applied through normal structures such as the skin without grave injury to them. In old persons too feeble for

operation, radium may be buried in the primary growth as a preliminary to x -ray treatment, especially if the growth is too massive to be penetrated by x rays from without. Radium is also suitable for the treatment of localized recurrent nodules which resist, or are not easily accessible to, x rays.

Marked and complete retrogression may occur in local masses of cancer cells subjected to radium, but only in rare cases can a cure of the disease be hoped for—namely, in cases where such a single mass of cancer cells is the only focus of growth present, and is unaccompanied by microscopic extensions of the disease in other parts.

Conversion of Inoperable into Operable Growths by Radium Treatment.—During the past year five cases have passed through my hands in which, when first seen, the growth was inoperable owing to its fixity on the chest wall. Following the application of radium to the primary growth, either by buried tubes or by a maximal surface application from a large mass of radium (5000 mgrm.), the growth has become mobile, and operable according to the usual clinical standards. Operation has been carried out, and the patients have made good recoveries and remained free from recurrence for periods varying up to a year. It is, of course, almost certain that the respite will be only temporary. Meantime the patients have been restored to activity and hope. Some of them will probably be spared the distress of a local recurrence, the last phase of their disease will be delayed, and when it comes in the form of intrathoracic recurrence it may be a short and merciful one.

The Routine Use of Radium at the time of the Primary Operation.—Though modern methods of operation, followed by the use of x rays, have almost abolished the early local recurrences which used to be so frequent, late recurrences in the supraclavicular and the anterior mediastinal glands are still deplorably common. For these recurrences the operator cannot be blamed, for they lie beyond the range of the operation. They indicate that even at the time of the original operation microscopic and undetectable advance parties of carcinoma-cells had already reached the glands in question.

Now it is quite possible to extend the scope of the operation to deal with this danger. Halstead at one time advocated the routine removal of the supraclavicular glands. But the operation for breast cancer, though safe, is already severe, and its prolongation is very undesirable. It is also possible to remove the anterior mediastinal glands, and I have done it in five cases without a fatality. A description of the method employed will be found in the second edition of my work on *Cancer of the Breast*. In only two of these cases were the glands found to be carcinomatous, and in both of these the operation failed to avert thoracic recurrence.

Faced by these unpalatable facts I determined a year ago to bury radium tubes at the time of the original operation in the situations where recurrence was most likely, that is to say, at the lower and inner angle of the posterior triangle, and at the inner ends of the first, second, and third intercostal spaces. The aim is the direct destruction of cancerous deposits in the glands while they are still microscopic. The method does not add to the severity of the operation, and only prolongs it by five minutes.

Time alone can determine the value of this plan, but during the year which has elapsed no recurrence has taken place in any of the cases treated by the method. Included in the number was a very rapid carcinoma in a lady of 33, pregnant seven months. In this case rapid recurrence seemed inevitable, but she remains well a year later.

Influence of Pleural Adhesions on Prognosis.—It is an interesting fact, and one which should be taken into account in estimating prognosis, that obliteration of the pleural cavity checks dissemination to an appreciable extent. This I have been able to show by analysis of the statistics of the Middlesex Hospital cancer wards. Marked pleural adhesions were present in 37 of the 329 cases. Cancerous invasion of the pleura was present in only 11 of these 37 cases, or 30 per cent, while of the sum total of Middlesex Hospital cases 44 per cent showed pleural invasion. In 3 of these 11 cases the adherent pleura on the side of the growth had escaped invasion, while the opposite non-adherent pleura was cancerous.

Doubt may at first appear to be thrown on this evidence of the protective action of an adherent pleura by the fact that only 30 per cent of the cases with pleural adhesions were absolutely free from metastases, as compared with 33 per cent of the sum total of cases. But the protective action of an adherent pleura extends only to the

thoracic cavity. It has been shown that in a large proportion of cases invasion of the abdomen occurs, not by way of the thorax, but directly through the epigastric parietes. Pleural adhesions do not check this process: perhaps, indeed, their resistance to the deep extension of the growth may accelerate the progress of fascial permeation, and so actually favour epigastric invasion. It is a most striking fact that 32 per cent of the 37 cases with marked pleural adhesions showed the abdomen invaded by cancer and the chest free, while only 12 per cent of a total of 329 cases showed a similar state of affairs. The converse difference is equally striking. While 22 per cent of the Middlesex Hospital necropsies show the thoracic cavity invaded and the abdomen free, only 5 per cent of the cases with pleural adhesions show a similar state of affairs. These facts are a strong indirect testimony both to the frequency of epigastric invasion and to the protection afforded by pleural adhesions to the thoracic cavity. Incidentally they provide a strong argument against the embolic theory, showing that invasion of the abdomen and invasion of the thorax are independent events.

The foregoing facts convey a therapeutic suggestion—namely, that if the pleural cavity on the affected side could be obliterated by artificially induced adhesions, life might be prolonged. Unfortunately the injection of irritant fluids into the pleura is known to be attended by danger. In two cases in which there was evidence of early pleural involvement at the base of one lung I have injected radium emanation, and a sterilized suspension of bismuth carbonate, respectively. In the latter case the injection was made as a preliminary to *x*-ray treatment. In neither case did any benefit result.

W. Sampson Handley.

BREAST, SIMPLE DISEASES OF.—We shall consider the prognosis of: (1) *Chronic mastitis*; (2) *Tuberculosis*; (3) *Fibro-adenoma*; (4) *Cysts*; and (5) *Paget's disease of the nipple*. None of these diseases involves any direct danger to life, and the interest of the prognosis centres around the possibility of the subsequent development of cancer.

1. Chronic Mastitis.—In young women this condition presents no immediate danger. After the age of forty it is to be regarded with grave suspicion. Very convincing evidence has now accumulated to show that cancer of the breast, like cancer elsewhere, is invariably preceded by chronic inflammation. Bryant found a history of mastitis in 80 out of 360 cases of cancer. Microscopically, Beadles was able to demonstrate pre-existing mastitis in every one of 100 breasts removed for cancer at the Brompton Cancer Hospital, although in the majority of the cases no signs had been evident clinically.

Quite apart from the possibility that mastitis may give rise to cancer, there is the very serious question of the uncertainty of the diagnosis of a lump in the breast. It is a sound surgical rule, at any rate after the age of thirty-five, that any lump in a woman's breast is better out than in.

2. Tuberculosis.—This is a very chronic disease, with no tendency to spontaneous cure. The breast eventually becomes riddled with abscesses, and in about 20 per cent of cases phthisis finally develops. It is wise, therefore, to effect an early clearance.

3. Fibro-adenoma.—Generally speaking, a mobile, well-encapsulated lump in a breast, confidently diagnosed as fibro-adenoma, is safe enough, and for years it does not alter in size. Microscopically, however, it is common to find that a recently observed tumour shows fibro-adenoma becoming malignant. There are a few cases on record of even old-standing and encapsulated swellings, undoubtedly innocent, eventually becoming carcinomatous. One of these is in the museum of St. Bartholomew's Hospital.

Removal of a genuine fibro-adenoma, verified as such by the microscope, is very rarely followed by recurrence.

4. Cysts.—In the majority of cases, of course, cysts of the breast remain innocent, and seldom attain any great size; but as Sir Lenthal Cheatle has recently shown, their presence may be the only evidence that a potentially malignant blocking of the ducts by epithelial hyperplasia has already developed. Also, their lining epithelium may undergo malignant proliferation, and give rise to cancer. For this reason, as well as the uncertainty of diagnosis before operation, cysts of the breast demand removal of the whole breast-tissue, leaving the nipple, skin, and axillary glands. Breast cysts are nearly always multiple, and one cannot tell that a malignant process may not start in one of the smaller cysts even if the most prominent are removed.

5. Paget's Disease of the Nipple.—This is not really a benign condition. If an apparent eczema of the nipple, in a woman over forty, fails to respond to treatment, and becomes red, raw, and angry, it is almost certain that the breast is already cancerous, though nothing can yet be felt. The tumour will become evident, generally in one to two years; but in rare cases it may be delayed for ten years. Fortunately the cancer is often of a slow type. The prognosis is, therefore, that of scirrhus. If treated by early radical removal on the lines of the modern operation for cancer of the breast, the results are as good as in the most favourable types of scirrhus, but exact figures are not available. Radium and α rays will frequently ameliorate the eczema, but will not prevent the onset of the cancer.

REFERENCE.—Cheatle, *Brit. Jour. Surg.* 1920, Oct., 149.

A. Rendle Short.

BRIGHT'S DISEASE.—(See NEPHRITIS.)

BRONCHIAL ASTHMA.—(See ASTHMA, BRONCHIAL.)

BRONCHIECTASIS.—When this is the sequel of measles or of whooping-cough in childhood, and the dilatation is moderate, recovery, often complete, is probably the rule rather than the exception, provided that death does not result owing to the severity of the primary disease. The more diffuse the bronchiectasis the worse is the prognosis, and consequently cases which are caused by pleural effusion, collapse of the lung, and especially unresolved pneumonia, usually run a shorter course than those due to chronic bronchitis.

The disease in a few cases runs an acute febrile course; but in the majority the tendency is towards chronicity, and instances are on record in which life was prolonged for forty to fifty years.

The prognosis in an individual case is difficult, for it is hard to estimate the risk of the complications which are usually associated with a fatal termination. The more immediate modes of death are marasmus, bronchopneumonia with septic absorption, hæmoptysis, pneumothorax, gangrene, tuberculosis, lardaceous disease, metastatic abscess (especially cerebral abscess), and cardiac and renal complications. In connection with this point, Lebert's figures of the effect of the disease on the general health in 80 cases are interesting:—

LEBERT'S 80 CASES SHOWING THE EFFECT OF BRONCHIECTASIS
ON THE GENERAL HEALTH.

Condition of Patient	No. of Cases	Percentage
General good health - - - -	17	21
Slight but distinct disturbance of health -	28	35
Marked disturbance without complication -	15	19
Marked diarrhoea with complications directly resulting from the disease - -	3	4
Marked disturbance with accidental complica- tions - - - -	*17	21

* The complications were: renal, 4; heart disease, 5; cancer of other organs than lungs, 4; tuberculosis, 1; pelvic abscess, 1; protracted whooping-cough, 1; chronic myelitis, 1.

Lebert gave the following figures as representing the duration of the disease in 52 cases: Under one year, 21.1 per cent; one to two years, 7.7 per cent; three to five years, 30.7 per cent; six to ten years, 15.5 per cent; over ten years, 25 per cent.

In an individual case, the general nutrition and the amount of absorption of bacterial products, the age of the patient, the extent to which his financial and other circumstances allow of adequate protection and medical care, and the presence of complications, must be taken into account. If there is little evidence of absorption of bacterial products, if the patient is well nourished, and if he can be properly safeguarded, the prognosis is, on the whole, towards chronicity. When, however, the complications previously mentioned occur, and especially when there is septic absorption, the prognosis is grave. The effect of the absorption of bacterial products upon the nutrition, and hence the tendency to fatal complications, has been diminished by the

effective use of creasote baths. Again, suitable treatment by vaccines, though it does not cure the disease, in some instances does much to diminish the septic character of the expectoration, and may render it odourless. Further, vaccine treatment appears not infrequently to reduce the number of intercurrent attacks of bronchopneumonia, pleurisy, and bronchitis, which do so much to undermine the patient's powers of resistance.

In generalized bronchiectasis, surgical measures are of no avail. Favourable results have been reported as the result of operation in cases in which there is a single dilatation, but in the majority even of these cases life is not prolonged by surgical means, and in not a few death may come sooner as the direct result. It is possible, however, that better results will be obtained by more modern methods.

Arthur Latham.

BRONCHITIS.

Acute Capillary Bronchitis.—This condition is always associated with some bronchopneumonia. It rarely attacks previously healthy persons, and is especially fatal to young children and old people. A severe attack in an infant may be fatal within twenty-four hours; an aged person may succumb in a few days.

In estimating the prognosis, we have to take into account the general surroundings and previous health of the patient. Unfavourable signs are failure of either the respiratory, circulatory, or nervous systems. Thus, the outlook becomes grave if there is urgent dyspnoea, or lessening frequency of cough or cessation of expectoration owing to feebleness; cyanosis or other signs of right heart failure; delirium, coma, or convulsions.

Acute Bronchitis of the Larger Tubes.—In mild cases the duration is as a rule from ten to fourteen days, but severe cases seldom last less than three to four weeks. Recovery is always slow if emphysema is present. There is a considerable tendency towards relapse, and the precautions taken to avoid this have much influence on both the immediate and remote effects. The disease is rarely fatal, save in young children and old people, in the acute asthenic type, or when the disease is a complication of nephritis, heart disease, diabetes, chronic bronchitis associated with heart failure, or emphysema; but the mortality is largely affected by adequate treatment. Signs of danger are: marked cyanosis, pulsating veins in the neck, great dyspnoea, short ineffective cough with cessation of expectoration, rapid irregular pulse, cold clammy skin, and a tendency to sink down in the bed.

Chronic Bronchitis of the Larger Tubes.—In young people marked improvement often occurs, and in a fair proportion of cases all urgent symptoms eventually disappear. After middle age there are few complete recoveries. This is chiefly owing to the recurrence of acute attacks and the increase of emphysema, more especially when the disease is dependent upon or associated with cardiac or renal disease. The course of the disease is, however, usually prolonged. The intensity of the symptoms, and hence the duration of the disease, are much affected by climatic conditions and by the amount of care the patient can devote to his health. Much can be done by medical treatment, such as vaccine therapy, to ward off acute attacks and to lessen the cough and strain upon the heart, while pressure baths often have a favourable influence upon the emphysema.

Plastic bronchitis affords a fairly good prognosis, and patients have been known to live for more than twenty-five years from the commencement of the symptoms. There is a tendency towards the development of ordinary bronchitis with its usual complications, and cases are recorded in which the casts have led to suffocation.

Purulent Bronchitis.—Epidemics of purulent bronchitis were studied during the war both in France and at Aldershot. The disease appears to be associated with the influenza bacillus. It is possible that pneumococci present in the lung develop a higher degree of virulence by symbiotic growth, and that the fatal termination, which may occur in as high a proportion of cases as 25 per cent, is due to a pneumococcal septicæmia.

Arthur Latham.

BRONCHOPNEUMONIA.—This disease is always associated with some capillary bronchitis. The prognosis is grave in every severe case, and the mortality may be as high as 30 or even 50 per cent. It is greatest in young children, and especially so in those below one year of age. In young infants, and in rickety or badly-nourished children brought up under insanitary conditions, the probability of a fatal termination is always considerable. This is especially true of bronchopneumonia complicated by whooping-cough.

The greater the extent of the disease, the graver is the outlook. Primary cases have a lower mortality than secondary ones: thus, bronchopneumonia following bronchitis has a mortality only half as great as bronchopneumonia following diphtheria. The chief immediate dangers are heart failure, convulsions, and hyperpyrexia: that is to say, the amount of toxæmia in relation to the patient's strength, and the extent of the disease, are the determining factors. Convulsions at the commencement of the disease have not so much significance as those of a later period. The character of the pulse is usually a better guide than the rate of breathing; a feeble, rapid, 'running' pulse is of graver significance than rapid respiration.

Bronchopneumonia may in a few cases lead to enlargement of the bronchial glands to a sufficient extent to be a source of trouble later on, to bronchiectasis, or to tuberculosis. As a general rule, bronchopneumonia which is an immediate sequel to an acute infection, such as diphtheria, is seldom if ever tuberculous, even though it runs a prolonged course and gives rise to great suspicion. On the other hand, a bronchopneumonia which commences more or less insidiously is often tuberculous in its origin, and is then nearly always fatal.

It is impossible to give the average duration of the disease, as cases vary so much according to the patient's previous condition and power of reaction. In all cases there is a great tendency towards relapse, and much care is required in convalescence, especially with regard to exposure.

In my experience, the administration of 5 c.c. of fresh normal horse serum by the mouth in the early morning so long as fever continues has had a marked effect in reducing the mortality of this disease.

Arthur Latham.

BULBAR PALSY.—Chronic bulbar paralysis of nuclear origin is, pathologically, the same disease as progressive muscular atrophy (*see* MUSCULAR ATROPHIES), but affecting the motor nuclei in the medulla oblongata. Its course is slow and insidious, and the prognosis is always unfavourable, most cases succumbing within a year, or at most two years, from the onset of the bulbar symptoms. Sometimes, however, the disease appears to be retarded, or even, for a few months, temporarily arrested, by the hypodermic administration of strychnine in full doses.

Sudden, so-called apoplectiform, bulbar palsy is always vascular in origin; it is generally due to arterial obstruction, and especially to syphilitic thrombosis. Where the bulbar palsy takes several hours, or even a few days, to develop (a less common occurrence), the condition is dependent upon acute inflammatory changes in the medullary nuclei, exactly similar to those which occur in the spinal cord in acute anterior poliomyelitis. The prognosis as to life in these two classes of bulbar paralysis is relatively good if the patient survives the acute stage, since the lesion is not a progressive one. The actual bulbar symptoms, however, remain stationary, for the nuclear disease is irreparable.

Other cases of bulbar paralysis are due to infranuclear and extramedullary lesions, implicating the motor nerves of the bulb below their nuclei of origin. Such cases occur in tumours, and in chronic meningeal affections, syphilitic or tuberculous. The symptoms develop much more slowly, and are often asymmetrical, and even unilateral, in distribution. Save in the cases of syphilitic origin, the prospects are unfavourable.

In **Pseudo-bulbar Paralysis**, where the patient has the same difficulty in articulation, deglutition, and phonation as in ordinary bulbar palsy, but without atrophy or fibrillary tremor of the affected muscles, the cause is entirely different. The lesion in such a case is a bilateral supranuclear one, situated in the pyramidal tracts. The common history is that of a patient who has had an ordinary attack of hemiplegia, without bulbar symptoms; he may have repeated attacks of this sort on the same side, all without the slightest bulbar phenomenon; at last, however, he has an attack of hemiplegia, slight or severe, on the opposite side; at once bulbar symptoms supervene, articulation becomes slurring, and deglutition becomes difficult. The sequence of events is so characteristic, that when we meet with a hemiplegic patient who has pseudo-bulbar symptoms, we can confidently diagnose a bilateral pyramidal lesion. The prognosis in pseudo-bulbar palsy is less grave, as regards life, than in true bulbar palsy, since the pseudo-bulbar symptoms do not tend to get worse, and may even improve to a considerable extent. The real prognosis depends on the cause which has produced the bilateral hemiplegia. (*See* STROKES.)

J. Purves Stewart.

BURNS AND SCALDS.—A burn may of course vary in degree from the merest trivial accident to an inevitably fatal destruction of an enormous skin area; but there are several points of importance which may guide us in prognosis.

The Nature of the Burn.—Skin area, not depth, is the determinant of the prognosis, except of course in rare instances where the abdomen may be opened. Thus a burn of the sixth degree involving the foot and lower part of the leg is not so dangerous as a wide-spread burn of the second degree involving the trunk and limbs. Third-degree burns, exposing the sensitive papillæ of the dermis, are particularly depressing. It is probably true that burns of the abdomen are the most serious.

If one-half of the body surface is burnt, death is inevitable; in the great majority of cases, a burn of one-third will also be fatal. In hospital practice about a third of the cases admitted, die; this of course varies with local custom, pressure on the beds, etc.

Influence of Age.—Children and aged persons are decidedly the more liable to die from the shock of a burn.

The Time Factor.—In the majority of the fatal cases, death takes place within forty-eight hours (128 out of 207 cases—Choyce), and no doubt most of these patients die from shock. Stupor, shallow breathing, prostration, and a quick weak pulse point to a probable fatal termination. There is, however, a curious group in which symptoms appear to be due, not to shock, but to some scorching change in the blood. Such cases may, for instance, develop signs of cardiac thrombosis two or three days after the accident, with dyspnoea, pain over the heart, and very irregular pulse; duodenal ulcer is probably another evidence of the same blood changes. Recurring vomiting may be due to a similar cause, and is of very grave import.

If the patient survives the first few days, the prospect of recovery, apart from complications, depends upon how effectually suppuration can be controlled. Pneumonia, pericarditis, and nephritis appear to be due in nearly every case to pyæmia from suppuration.

The Effect of Treatment.—There is no doubt that careful treatment may make all the difference between life and death in a considerable number of the cases. Extensive lesions of the skin do not produce shock in animals or in man under an anæsthetic, and the shock of a burn is due principally to pain, and can be controlled by efficient doses of morphia. The early dressings ought to be rendered painless by chloroform or morphia, for this reason. Warmth is a very important factor in saving the patient's life. The blood changes are probably beyond our control. The writer has shown that in some cases of severe burns the specific gravity of the blood is much raised, and the administration of saline is urgently indicated.

If the burn is not so extensive as to be inevitably fatal, it is well worth while to take particular care to prevent sepsis later. If the injured area has been fouled, it should be surgically cleansed under an anæsthetic. Reliable antiseptics, like oil of eucalyptus (1 in 20 in olive oil), improve the prognosis, and so does a boracic bath applied for several hours daily; but cases have undoubtedly been lost by drug poisoning. The incessant vomiting and dermatitis of boric-acid poisoning are not as well recognized as they should be.

Complications.—*Pneumonia*, *pericarditis*, and *nephritis* can usually be prevented by proper asepsis. *Duodenal ulcer* does undoubtedly occur, usually a week or ten days after the burn, but it is rarer than was formerly supposed. Moynihan, in his classical study of duodenal ulcer, was able to find only the merest handful of authentic cases. Out of 138 deaths from burns at St. Bartholomew's Hospital, Lockwood found only 1 duodenal ulcer, with 2 other cases showing punctiform hæmorrhages. In a few rare instances the ulcer has caused death from perforation or hæmorrhage. These ulcers are probably due to microscopical embolism of the duodenal arteries on account of the blood changes, followed by self-digestion by the juices of the stomach or pancreas.

Tetanus is not very rare as a complication of a burn, and particularly if it is earth-infected. Fourth of July tetanus following burns from fireworks is well known in America. Patients with earth-infected burns ought to be given a prophylactic dose of antitetanic serum.

Contraction with deformity is a very distressing late complication of burns. It only occurs if the whole thickness of the skin is destroyed. Something can be done to prevent

it by liberal skin-grafting. The writer has seen one case in which it led to dislocation of the hip-joint.

Keloid and *epithelioma* may develop in the scar of an old burn. *X-ray* burns appear to be particularly liable to undergo malignant changes, several members of our own profession having fallen victims.

Scald of the Larynx.—Children who have been trying to drink from the spout of a kettle are liable to this accident. Unfortunately there may be no signs at all, or at most only a little hoarseness, for several hours, and lives have been lost by children being sent away from a hospital at this stage. A few hours later they are brought up again with laryngeal stridor, cyanosed, and struggling for breath, when even an immediate tracheotomy may be too late to save the situation. With proper supervision and prompt interference if necessary, there is no great danger. *A. Rendle Short.*

CÆCUM, TUBERCULOUS.—This somewhat uncommon disease is usually diagnosed as carcinoma, forming, as it does, a hard tumour-like mass in the cæcum. We have not much information as to the natural course of the complaint. It is customary to remove the cæcum. The mortality after removal by operation is given as follows: Of 58 cases in the literature since 1900, 12 per cent died (Hartmann); of 130 other cases in the literature, 30 per cent died after excision, and 17 per cent after short-circuiting (Nikoljski); of 46 cases of four surgeons since 1907, 25 per cent died (Finkelstein). The last figure is probably a fair approximation to the truth.

If the patient survives operation, a cure usually results.

REFERENCES.—Finkelstein, *Arch. f. klin. Chir.* 1913, July, 936; Makins, *Burghard's System of Operative Surgery.* *A. Rendle Short.*

CÆSAREAN SECTION.—The chief points which arise in the prognosis are: (1) *The immediate prognosis*: what is likely to be the mortality of the operation in the various conditions for which it is performed? (2) *The remote prognosis*: what is the risk of rupture of the uterine scar in subsequent pregnancies or labours?

1. The Mortality of Cæsarean Section.—The latest statistics are those obtained by Munro Kerr and Eardley Holland, who in 1921 organized a collective investigation into the results of Cæsarean sections performed in hospitals in Great Britain and Ireland during the years 1911-20 inclusive. The full analysis of these 4197 operations is published by Eardley Holland in the *Journal of Obstetrics and Gynæcology of the British Empire*, 1921, xxviii, 358. First and foremost must be made the essential distinction between the mortality of the operation as performed on healthy women before the onset of labour, and the mortality of the operation when performed in the presence of possible intra-partum sepsis or for complications such as eclampsia, ante-partum hæmorrhage, and so on. The true mortality of the operation *per se* is obtained by taking cases where it was performed for contracted pelvis in healthy patients who were not in labour—where, therefore, there was no risk of intrapartum sepsis due to vaginal examinations, rupture of the membranes, or prolonged labour. In such favourable circumstances the operation is a particularly safe one in the hands of a skilful operator and in favourable surgical surroundings. But very remarkable is the progressive rise in mortality as the risk of intra-partum sepsis, or the unfavourable state of the patient, increases. In Eardley Holland's analysis, the following figures were obtained in cases of contracted pelvis:—

MATERNAL MORTALITY IN CÆSAREAN SECTION FOR CONTRACTED PELVIS.

When Performed	Total Cases	Maternal Deaths	Percentage
Not in labour - - -	1189	18	1·4
Early in labour - - -	384	7	1·8
Late in labour - - -	213	20	9·4
After induction of labour	35	5	14
After attempts at delivery by forceps or craniotomy	102	27	26·5

The high mortality after cases long in labour, and especially after attempts at delivery, is an indication of the risks likely to be incurred when the operation is performed under such circumstances; but an immense factor for good or evil is, of course, the way the patient has been handled prior to operation, and whether examinations and manipulations have been made with strict aseptic precautions or otherwise.

The foetal mortality in cases where forceps had been tried and failed amounted to 27 per cent in the above series, and the early mortality of the infants who survived delivery was 11 per cent. The foetal or infant mortality in such cases is from subdural cerebral hæmorrhage due to forceps-pressure; it is important to bear in mind that cerebral hæmorrhage does not interfere with the action of the foetal heart, but paralyzes respiration; so that although intra-uterine existence is not interfered with (the foetal heart will therefore be heard before delivery), the foetus cannot breathe after birth. The maternal mortality of Cæsarean section is almost entirely due to septic infection, leading as a rule to general peritonitis; pneumonia (probably of septic origin), pulmonary embolism, and post-partum hæmorrhage account for a few cases of death.

Cæsarean Section for Eclampsia.—In Kerr and Holland's series the maternal mortality of abdominal and vaginal Cæsarean section for eclampsia worked out at 61 deaths in 190 cases, or 32 per cent. The foetal mortality-rate was 32 per cent, and the mortality-rate amongst the infants who were delivered alive was 11 per cent. The maternal mortality must not be taken to indicate the mortality of the operation when undertaken *early in the disease* and *for all cases of eclampsia* (i.e., mild as well as severe cases). In this series many of the cases were of a very severe type, in a late stage of the disease, and after expectant treatment had failed. The matter is more fully discussed in the article on ECLAMPSIA, to which the reader is referred.

Cæsarean Section for Placenta Prævia.—In Kerr and Holland's series there were 78 cases of complete or central placenta prævia, with a mortality of 14 per cent, and 43 cases of incomplete placenta prævia, with a mortality of 9 per cent. The chief cause of death was sepsis and general peritonitis, and a few died of hæmorrhage and shock. Many of the patients were in bad condition, already suffering from the effects of hæmorrhage. If the operation is performed in carefully selected cases, when the patient first comes under observation, before she is suffering from great loss of blood and intra-partum infection, there is no reason why Cæsarean section for placenta prævia should be accompanied by a higher mortality than for clean cases of contracted pelvis, namely, 1.5 to 2 per cent. But it is doubtful if the results of Cæsarean section, as regards the mother, taking a wide selection of cases, are any better than those got by the conservative methods of skilful midwifery.

The results for the foetus are, of course, extremely flattering: in Kerr and Holland's series the foetal mortality for all cases was 7 per cent, whereas the foetal mortality associated with the conservative methods of version or hydrostatic bags is given by most observers as from 40 to 60 per cent. Cæsarean section is likely to give an all-round better prognosis in the following type of case: a primigravida, at or near term, in good condition, not in labour, the cervix closed, the placenta completely covering the internal os, the foetus alive. But too much importance should not be given to the foetus, since the operation is undertaken primarily in the interests of the mother; in cases where a woman is particularly anxious to have a live child, for example in a primigravida of over forty, the foetal indication becomes a strong one.

Cæsarean Section for Accidental Hæmorrhage.—In cases of external accidental hæmorrhage the operation is seldom indicated; but in severe cases of the concealed type, where careful observation shows that the hæmorrhage is progressive in spite of the administration of pituitrin and the application of a tight binder, it is usually the only means of saving the patient's life. In Kerr and Holland's series there were 58 cases of 'concealed' or 'concealed and revealed' hæmorrhage, with a maternal mortality of 29 per cent. A very striking point brought out in the analysis was that the mortality after Cæsarean hysterectomy was about four times as great as after simple Cæsarean section. The operator should bear this in mind, and not be tempted to remove the uterus because its wall is infiltrated with blood or because its contraction and retraction are temporarily delayed. Nearly all these patients are in a state of severe toxæmia, and in a very poor condition to withstand the extra shock of the severer operation.

2. The Risk of Rupture of the Uterine Scar in Subsequent Pregnancy or Labour.—

This aspect of the subject has been very fully investigated by Eardley Holland, who, in 1920, organized a collective follow-up investigation into a large series of cases of Cæsarean section performed by British obstetric surgeons between the years 1911 and 1918 inclusive. As the result of this work we are now aware that the risk of rupture of the scar is a more serious menace than was formerly believed, and know precisely what the percentage risk of rupture is, and in what type of case it is most liable to occur. His figures may be summarized as follows :—

Total number of Cæsarean section patients (excluding fatal and sterilized cases)	-	-	-	-	-	-	-	-	-	1605
Number followed up	-	-	-	-	-	-	-	-	-	1103
Number in whom no subsequent pregnancy occurred	-	-	-	-	-	-	-	-	-	616
Number who subsequently became pregnant	-	-	-	-	-	-	-	-	-	487
<i>Results of pregnancies :—</i>										
Delivery by natural passages	-	-	-	-	-	-	-	-	-	78
Repeated Cæsarean section	-	-	-	-	-	-	-	-	-	352
Abortion	-	-	-	-	-	-	-	-	-	47
Pregnant now	-	-	-	-	-	-	-	-	-	86
Rupture of scar	-	-	-	-	-	-	-	-	-	18

A subsidiary point which came out was the high percentage of sterility which follows the operation ; it appeared that the sterility was chiefly voluntary, owing to the patient's dread or dislike of a repeated operation. The above cases of repeated Cæsarean section, delivery by the natural passages, and rupture of the scar add up to 448 ; since the number of ruptured scars was 18, the frequency of ruptured scar was 18 in 448, or 4 per cent. It is also to be noted that the proportion of ruptured scars to delivery by the natural passages was 18 to 78, or 1 to 4·3.

The important points in prognosis, in the case of a patient who has had a Cæsarean section are : (1) Is the patient liable to get a ruptured scar in a future pregnancy or labour ? (2) Should she be allowed to deliver herself naturally, or have another Cæsarean section ? As regards the second point, if the indication for the original operation was pelvic contraction, she should obviously have another Cæsarean section ; but many patients who have had the operation may have nothing to prevent them, in the event of a future pregnancy, from delivering themselves by the natural passages—e.g., when the indication for the original operation was eclampsia or ante-partum hæmorrhage. Rupture of the scar is a very treacherous accident, and the likelihood of its occurrence can by no means always be suspected or guarded against. For example, in the recorded cases rupture occurred almost as often during pregnancy as during labour, and many cases have been recorded as early as the seventh month. Again, several cases have been recorded in which the patient has safely delivered herself at full term after a Cæsarean section, but in which the scar has given away during a still later pregnancy or labour.

The chief cause of the ruptured scar is imperfect healing of the uterine incision, leading to a thin scar in which muscular union has failed and which consists almost entirely of peritoneum and decidua with a varying amount of intervening fibrous tissue. Imperfect healing is nearly always due to infection of the uterine wound. There can be no doubt that imperfect suturing of the uterine incision is also an important cause of thin and imperfect scars. All thin scars stretch during pregnancy, and rupture may be determined solely by the intra-uterine tension of normal pregnancy or by the contractions of normal labour ; or rupture may be favoured by such accidental factors as insertion of the placenta over the scar, with partial separation of the placenta and retroplacental hæmorrhage (which cannot possibly be foretold or avoided) ; or by overdilatation of the uterus by hydramnios or twin pregnancy, by prolonged or obstructed labour, by operative interference such as internal version or the use of hydrostatic bags, or by the administration of such drugs as pituitrin.

When, therefore, the problem of how to manage a future pregnancy or labour has to be faced, all the above points must be taken into consideration. There can be no doubt that a patient who has had a Cæsarean section must be kept under very close observation during the last month of pregnancy. Is the advice 'once a Cæsarean always a Cæsarean' always true ? By no means. If the patient has had a febrile convalescence from her

operation, or if there have been other signs of wound-infection, she very likely has a weak sear, and should be advised to have another Cæsarean section. But where the recovery has been afebrile, where the present pregnancy is normal and there is no cause to anticipate any difficulty in labour, she may be allowed to deliver herself naturally, but should be in surroundings where she can get prompt surgical assistance should the necessity arise.

Eardley Holland.

CALCULI.—(See **BLADDER, CALCULUS OF; KIDNEY AND URETER, CALCULUS OF; PROSTATIC CALCULI.**)

CANCER.—(See *Various Organs.*)

CANCERUM ORIS.—This term should not be used for cases of severe stomatitis unless there is black sloughing of the cheek. Interpreted in this way, the prognosis is very grave—it is given by Keen as 75 per cent. Death takes place within ten to fourteen days. Even if the child recovers, there is usually a horrible deformity which will require much skill and many operations to remedy.

The outlook in a particular case depends on the extent of the sloughing and on the degree of toxæmia. If the patient is already worn out by measles or other illness, if there is a poisoned look, high fever, weak pulse, or coughing, death is almost inevitable. The best hope of recovery is in a case seen early, not extensive, promptly treated, and with little toxæmia.

A. Rendle Short.

CARBUNCLE.—Although usually not a dangerous disease, it must always be borne in mind that a large carbuncle involves serious danger to life when it occurs in a vascular part, such as the lip or face; also in elderly, alcoholic, diabetic, or broken-down individuals. Spreading in spite of treatment, delirium, pyæmic abscesses, or rigors all mean a grave prognosis. Of cases sufficiently severe to be admitted to a hospital, about a quarter die.

A. Rendle Short.

CARDIAC SYPHILIS.—As this subject is largely covered elsewhere in this volume, by articles on aortic valvular disease, angina pectoris, syphilis, and so on, a short note is added under this heading merely to co-ordinate the leading facts.

The effects of syphilis on the heart and aorta are threefold, in that the infection attacks the aortic wall, the aortic semilunar valves, and the myocardium itself through the medium of the coronary arteries. It is the relative severity of its attack on these three several parts of the circulatory apparatus that determines the prognosis. When it is the aorta that suffers most, and an aneurysm is produced, this throws so powerful an extracardiac bias into the situation that the whole outlook is practically conditional on the behaviour of the aneurysmal sac. Usually, therefore, when we speak of the prognosis in cardiac syphilis, it is of the valvular and myocardial lesions that we are thinking. Here it may be remarked that timely recollection of the possibility of a syphilitic element in aortic regurgitation and obscure cases of angina and myocardial weakness, will stimulate investigation by means of the Wassermann reaction, searching for signs of cerebrospinal lesions, and so on, and discovery of information that will be of the utmost service for prognosis as well as treatment.

Prognosis as to Life.—Deneke found that about half died within two years of the initial diagnosis; about two-thirds within three years; and about four-fifths within four years. It is true that these figures, drawn from the histories of 124 patients, do not exclude cases of aortic aneurysm; but he shows that the outlook is only twice as bad when there is an aneurysm, with or without valvular incompetence, as it is in cases of aortitis without aneurysm; and further, that the prognosis is nearly as bad in cases of valvular insufficiency without aneurysm as it is when aneurysm is present. Mitchell Bruce found that the average expectation of life in cardiac syphilis, from onset of symptoms to death, was between five and six years.

The great proneness of these cases to a sudden end is notorious. One of the physicians at whose feet the writer sat as a student used to emphasize this by telling stories of patients who had died on the doctor's doorstep, "with a gumma in the heart and an iodide prescription in the pocket". In 74 fatal cases observed by Deneke, the end was

sudden in no less than 33 (24, if deaths from bursting aneurysms be excluded). Of Mitchell Bruce's cases of cardio-aortic syphilis, aneurysms excluded, 50 per cent died suddenly. This insecurity of life is due to the fact that, as Harlow Brooks and others have shown, gross myocardial lesions are to be found in a large majority of all cases of cardio-aortic syphilis.

Apart from the development of aneurysm, the factors of danger in cardiac syphilis are, first, damage to the myocardium, and second, addition to its work by failure of the aortic valves. Of these the first is clearly the more important by far; so that in seeking to form an opinion as to the prospects in any individual case, the most important data are those that bear on the condition of the cardiac muscle.

The evidences of ventricular disease may be local or diffuse. The former class includes the signs of acute obstruction of a coronary artery or branch—development of a pericardial rub following a severe attack of precordial pain with faintness; also signs of gradual coronary obstruction, or rather of its chief result, formation of an aneurysm of the heart; and heart-block. Of these, the two first are the more immediately prophetic of sudden death; and indeed there is nothing of more ominous significance in these cases than the appearance of a pericardial rub, even where this has been preceded by no other evidence of infarction. Anything indicative of coronary obstruction carries with it a threat of sudden death. With heart-block it is a little different, for its appearance can only endanger the patient's life if it is accompanied by syncopal or epileptiform attacks. Although the type of lesion conjured up in the mind by the term 'myocardial syphilis' is focal, yet it must never be forgotten that those same focal lesions are merely the macroscopic expression of a widespread interference with the nutrition of the heart muscle by disease of the coronary arteries. Hence we must look out for and correctly interpret such symptoms as recurrent precordial pain on exertion, dyspnoea, puffiness of the ankles, alternating pulse: all these prove that the ventricular muscle is hard hit and likely to give out at no distant date.

Although it is true that the myocardial factor is in general the more important, yet there are cases of cardiac syphilis in which the valvular element suddenly takes the centre of the stage. These are the cases in which the aortic valve becomes incompetent quite abruptly, either as an obvious result of some strenuous effort, or without any definite provocation. It is, of course, a difficult matter in most cases to be sure that the valvular failure is really as sudden as it seems, but there is a good deal of evidence, both clinical and pathological, to support a belief in the occasional occurrence of rupture of an aortic cusp already weakened by syphilitic disease. Sudden addition of so grave a task to the work of an already unhealthy myocardium obviously introduces a new threat into the case. Death may be sudden, but more often the patient's expectation of life is reduced, in a frankly syphilitic case, from a matter of several years to one of months. The myocardium, though presumably diseased, may adapt itself wonderfully to its new burden if the patient be rested and cared for in the meanwhile.

One other risk has to be borne in mind in cases of cardiac syphilis—that of the development of syphilitic lesions in other vital organs. One man recently under the writer's care with aortic dilatation and incompetence, of luetic origin, died rather suddenly of a large cerebral thrombosis. Deneke found death due to extracardiac causes in about 20 per cent of his fatal cases.

As to the result of treatment, Deneke found in his series that thorough treatment with antisyphilitic drugs doubled the patient's expectation of life. The best method of treatment is still a matter of discussion. From the prognostic point of view it may be stated that, as far as is known, thorough treatment with mercury, either by inunction or injection, together with iodides, gives results as good as those following the use of salvarsan; while most observers agree that the latter plan introduces a considerable element of risk, at all events in cases where the evidences of myocardial invasion are at all definite. Even those who advocate salvarsan say that repeated administration is essential and that mercury should be given as well; so that it seems as if the prospect of radical cure were no brighter with this than with the older remedies adequately employed.

Carey F. Coombs.

CATARACT.—

Senile Cataract.—Senile cataract usually makes its first appearance either as *radial striæ* of opacity running from the equator of the lens towards the centre, like the spokes of a wheel, or as irregular *clouding of the central region* of the lens. The former, commoner variety is often diagnosed by the surgeon, in examining the eye for refraction error or other reason, before the patient is aware of its existence. In such a case the surgeon, while noting the condition, and especially the health or otherwise of the fundus, usually need not alarm the patient by telling him that he has ‘cataract’, although the state of affairs may be explained to the patient’s friends. The word ‘cataract’ is one which the majority of patients, without understanding it, regard with dread, associating it with permanent blindness. The patient may, however, be told that the focus of his eyes may alter rapidly, and that he should consult his oculist at intervals.

The cause of this alteration in the refraction is the sclerosis of the lens which causes an increase in its refractive index. The eye tends to become myopic (or less hypermetropic), often irregularly. When it becomes obvious to the patient that his vision is distinctly impaired and cannot be improved by lenses, the condition must be explained to him, and the prospect of useful vision being regained by operation discussed.

The time required for a cataractous lens to become completely opaque (mature) varies greatly, some becoming mature in a few months and others remaining unchanged for many years. Those which increase most slowly are those which appear as fine, separate, regularly arranged, radial striæ, which are grey rather than white on examination by focal illumination. Jessop¹ suggests that this form of lens opacity should be called by some other name than ‘cataract’, and suggests ‘arcus senilis lentis’. Traumatic cataracts, those due to diabetes, nephritis, and arteriosclerosis, and those associated with disease of the eye, such as retinal detachment, glaucoma, and uveitis, mature rapidly.

Senile cataract appearing before the age of 50 matures more rapidly than in older subjects.

The causation of senile cataract is obscure, although heredity is a factor, as are also the factors which determine whether a cataract shall mature rapidly or slowly; but where it is incipient and the eye has useful vision, the patient’s general health should be kept at the highest pitch, and especially should sources of infection, such as pyorrhœa, carious teeth, dyspepsia, and constipation, be dealt with.

Spontaneous Cure.—A few cases of spontaneous absorption of cataract have been recorded, and in some of them useful vision has resulted²⁻⁷. In many, however, the absorption of the cataract occurred after some disease of the eye. The writer has seen a case where the cataract had absorbed completely, affording a perfect view of the fundus, but the eye was useless from optic nerve atrophy. In any individual case the likelihood of cure without operation is so small as to be negligible.

Operation for Cataract.—The most favourable conditions for operation are :—

1. The cataract mature ;
2. The rest of the eye healthy ;
3. Absence of sepsis, local or remote ;
4. Absence of general disease or great debility in the patient.

A cataract is *mature* when the whole of the cortex of the lens has become opaque. Later, the cortex begins to liquefy and the cataract becomes *hypermature*. The most favourable stage for operation is when the most external layer of the cortex has become liquid, so that the opaque lens is separated from its capsule by a very thin layer of fluid. A cataract operated upon at this stage comes wholly and cleanly out of the capsule, leaving behind no débris of lens matter between the layers of the capsule or in the anterior chamber.

Immature Cataract.—Less favourable for operation are the earlier and later stages, immature and hypermature cataract. It may be necessary to operate upon an immature cataract especially when the lenses in both eyes are becoming opaque at about the same rate, to save the patient the misery of waiting, unable to read, for both cataracts to mature.

The prognosis of operation on immature cataract is less good because, while the nucleus and most of the cortex come away easily, some of the soft, sticky cortex remains behind in the eye. From this may result one or more of the following sequelæ :—

1. Cortex remaining between the layers of the capsule of the lens becomes opaque, causing a more or less dense 'secondary cataract' or 'opaque capsule'. This calls for the subsequent operation of capsulotomy, making an opening in the opaque capsule, the ease and success of which will depend chiefly on the density of the opacity.

2. Lens débris in the anterior chamber disposes to *iritis* as a complication.

3. Lens débris, either as solid masses or dissolved in the aqueous, carried away to the angle of the anterior chamber tends to obstruct the normal exit of fluid from the eye, and may cause *glaucoma*.

4. Lens débris is a good culture medium for micro-organisms, and increases the risk of infection, either hæmatogenous or from organisms introduced at the operation.

To reduce the risk of these sequelæ, recourse is sometimes had to one of the methods of artificially maturing the cataract, or to irrigation of the anterior chamber to wash out the lens débris. These methods, however, have their drawbacks and are not adopted by the majority of surgeons who, when it is necessary to operate on an immature cataract, rely rather on a free opening of the anterior capsule to permit of removal of most of the cortex and ready access of the aqueous to what remains.⁸

Hyper mature Cataract.—After the stage of maturity is reached, the cortex of the lens continues to liquefy and disintegrate until only the nucleus remains solid. The liquefied cortex is either absorbed as the disintegration proceeds, or remains in the capsule. In the former case the cataract becomes a firm opaque disc, in the latter it becomes a sac of fluid with the solid nucleus at the bottom ('Morgagnian' cataract). The anterior capsule becomes thickened, and lime salts are often deposited in it. This renders it difficult to open the capsule at the operation, and the pressure intended to do this may suffice to dislocate the lens into the vitreous.

At a later stage, the suspensory ligament of the lens becomes stretched and atrophic, and the lens may, from this cause, be dislocated into the vitreous, spontaneously or at operation. This accident usually causes *glaucoma*, and results in the loss of the eye.

The second question upon which a favourable prognosis depends is—*Is the rest of the eye healthy?* In respect of the anterior part of the eye it is easy to answer this question. If the eye *squints*, or has *nystagmus*, this suggests that it is amblyopic, and will not see well even after a surgically perfect operation. A *central nebula of the cornea* will also be obvious and may spoil a perfect operative result. *Posterior synechiæ* from old *iritis* increase the mechanical difficulties of the operation, and it is almost certain to be followed by a fresh attack of *iritis*, with, possibly, closure of the pupil by scar tissue. Usually, however, it is slight and yields to treatment by atropine. If the *iris* be *discoloured* and atrophic, wholly or in patches, this indicates that there has been disease which has interfered with its nutrition, and such an eye has a greatly increased liability to complications.

As to the condition of the *fundus oculi*, if the surgeon sees the patient while the lens is still sufficiently transparent for him to see the fundus, he will, of course, carefully note its condition, especially as regards the macula, the disc, and the vessels.

If the lens is already opaque, he must rely for information as to the health of the fundus upon the following signs:—

1. The reaction of the pupil to light should be brisk;

2. The patient should appreciate the shadow of an object passed between him and the light ($V =$ shadows).

3. He should be able to recognize promptly and accurately the direction from which light comes when thrown on to the eye from all directions. This last examination gives the extent of the 'light field'. Inaccuracy in any direction indicates gross disease of the fundus and an unfavourable prognosis.

Myopic eyes tend to have unduly fluid vitreous and are therefore more liable to loss of vitreous at operation, and to post-operative detachment of the retina. Cataract in eyes which are known to have been highly myopic should either not be operated upon, or a very guarded prognosis should be given. (*Vide MYOPIA*.)

Sepsis.—*Conjunctivitis* is a contra-indication to operation, and that condition must be thoroughly treated before any operation is undertaken. *Lachrymal obstruction* and, still more, *dacryocystitis* involve a high bacterial content in the conjunctiva, and these conditions must be treated before operation. If necessary, the canaliculi may be temporarily sutured or sealed with the cautery.

Besides local infection, the possibility of *infection of the eye from the blood-stream* must be taken into consideration. The common source of blood-borne infection is the alimentary tract, and pyorrhœa, carious teeth, chronic dyspepsia, constipation, and colitis may all give rise to post-operative complications. Of these, pyorrhœa is the most fruitful source of trouble, and no operation for cataract should be undertaken until the mouth has been put into the best possible condition.

General Disease or Debility in the Patient.—

Diabetes.—Patients suffering with diabetes are no less liable than healthy persons to senile cataract, and about 4 per cent of patients with cataract have sugar in the urine. The prognosis of senile cataract in patients with diabetes is not appreciably worse than in healthy patients, but they should be got into the best possible condition before operation. True 'diabetic cataract' appears not as striæ, but as an irregular opacity just below the capsule, the opacity rapidly involving the whole lens, in both eyes. When such a cataract occurs in a young person, with much sugar, acetone, and diacetic acid in the urine, there is an increased liability to hæmorrhage and to iritis, and diabetic coma is a possible occurrence. Generally, however, diabetic cataract behaves as well as does the senile form.

Albuminuria and Arteriosclerosis.—These have little influence on prognosis. About 20 per cent of patients with cataract have albuminuria, and almost all have arteriosclerosis. When either condition is advanced, there is an increased liability to complications, especially hæmorrhage and wound infection. The appearance of the patient is the best indication as to whether an operation should be performed. If a patient is known to have renal retinitis, his eye should not be operated upon.

Complications.—The effect of complications on the result of operation may now be considered.

Iritis and Iridocyclitis.—A mild degree of iritis after operation is not uncommon, and usually does not affect the result. It may be due to bruising of the iris during the extraction, or a mild infection introduced at the time of operation from the conjunctival sac, or from the blood-stream. It is more likely to occur, as mentioned above, if soft lens matter remains in the anterior chamber. In the great majority of cases it yields readily to treatment by atropine, and even if some points of adhesion of iris to lens capsule remain, there is only slight delay in convalescence.

Where the infection is graver, there is iridocyclitis, evidenced by deposits of fibrinous exudate on the back of the cornea (keratitis punctata) or by a collection of fibrin and pus-cells in the anterior chamber (hypopyon). Treacher Collins⁹ reports 518 cases of cataract extraction: with severe iridocyclitis in 36 cases (7 per cent); 28 with keratitis punctata; and 8 with hypopyon. The result of this complication is usually that the pupil and coloboma fill with exudate, which on cicatrizing draws the pupil up to the wound. In a few of these cases, a subsequent iridotomy gives the patient useful vision, but more often the eye shrinks and becomes blind. *Secondary glaucoma* may occur acutely from blocking of the angle of the anterior chamber with exudate, or slowly as the iris scars.

Panophthalmitis.—A gross infection at the time of operation or subsequently may lead to loss of the eye from suppuration. In Collins' series this occurred in 6 cases (1·15 per cent). Earlier statistics show a greater number of losses from this cause.

Sympathetic Ophthalmitis.—A rare sequela of post-operative cyclitis in the operated eye is sympathetic cyclitis in the other. In Collins' series this occurred in 5 cases (0·9 per cent).

Hæmorrhage.—Slight hæmorrhage into the anterior chamber at the time of operation is common, and is of no importance, the blood being rapidly absorbed. Rarely, owing to disease of the iridic and ciliary vessels (from arteriosclerosis, diabetes, etc.), or to diminished blood coagulability, the hæmorrhage is sufficient completely to fill the anterior chamber. This may absorb without damaging the eye. On the other hand, it may lead to atrophy of the optic nerve from the increased intra-ocular tension produced, or it may leave an opacity of the posterior surface of the cornea.

Expulsive Hæmorrhage.—This is a large hæmorrhage from the retinal or choroidal vessels at, or soon after, the operation. The blood expels the vitreous from the eye, and the eye is at once lost. This occurred in one of Collins' cases (0·19 per cent).

Loss of Vitreous.—Vitreous may escape from the eye at the operation. Healthy vitreous may be lost from the use of excessive pressure in delivering a large lens, or a lens

of normal size through a section too small for it, or because of a movement on the part of the patient. Such loss of normal vitreous is usually small in amount, and need not affect the result. Fluid vitreous may be lost through no fault of surgeon or patient. This may be large in amount, and occurs in unhealthy eyes, especially in high myopia (*vide supra*).

The frequency of this accident varies much with different operators; in Higgens'¹⁰ series of 130 extractions it did not occur once.

Visual Results of Operation.—In considering statistics on the visual acuity, one has to remember that much depends on the intelligence of the patient, and more upon the care and time expended by the surgeon in correcting the focus errors after operation. Further, a surgeon who selects the cases on which he operates is likely to get better results than one who operates upon any case in which there is a prospect of obtaining useful vision.

In the majority of cases (50 to 75 per cent) the vision is improved by the operation of capsulotomy performed a month or more after the extraction. Higgens'¹⁰ results are as follows:—

Of 130 eyes, 115 had vision = 6/24 or better. Of the remaining 15, in 7 cases the bad vision was due to some cause other than the cataract (mainly fundus disease), and in 8 the vision was likely to have been improved by capsulotomy.

In the 115 cases with vision = 6/24 or better, the vision was: 6/6 in 9 (7·8 per cent); 6/9 in 34 (29·5 per cent); 6/12 in 40 (34·8 per cent); 6/18 in 25 (21·8 per cent); 6/24 in 6 (5·2 per cent); Jaeger 4 in 1 (0·9 per cent); this patient was bedridden.

Of the 115 cases, capsulotomy was done in 59. All the cases occurred in private practice.

Treacher Collins⁸ reports 200 cases, in 145 of which the vision after operation was recorded. Of these, 51 could read 6/6 or part of 6/6 without capsulotomy.

Jackson¹¹ reports 50 cases from his private practice. His results are: 6/6 or better in 8; 6/7½ in 4; 6/9 in 5; 6/12 in 5; 6/13½ in 5; 6/15 in 1; 6/18 in 1; 6/22 in 4; 6/30 in 6; 6/37 in 1; 6/45 in 1; 6/90 in 5; less than 6/90 in 4.

Capsulotomy was done in 17 cases (34 per cent).

REFERENCE.—¹Jessop, *Trans. Ophthalmol. Soc.* xxxiv, 1914; ²Nettleship, *Ibid.* v, 1885; ³Kipp, *Amer. Jour. of Ophthalmol.* 1887, iv, 157; ⁴Mitralski, *Centralb. f. prakt. Augenheilk.* xvi, 289; ⁵Baquis, *Ann. di Ott.* xxxvi, 76; ⁶Pyle, *Phil. Med. Jour.* 1900, March; ⁷Augieras, *L'Ophthalmologie provinciale*, 1904, Sept.; ⁸Treacher Collins, "Capsular Complications after Cataract Extraction", *R. Lond. Oph. Hosp. Reports*, xvi, part 3; ⁹Treacher Collins, *Trans. Ophthalmol. Soc.* 1914, xxxiv; ¹⁰Higgens, "Notes on 130 Consecutive Extractions of Cataract", *Lancet*, 1907, 1003; ¹¹Jackson, *Trans. Amer. Ophthalmol. Soc.* xiii, 1912.

Arthur D. Griffith.

CELLULITIS.—The prognosis in cellulitis depends upon the location, the condition of the patient, and the extent of the disease. Of 889 cases at St. Bartholomew's Hospital, a good many years ago, when the condition was commoner than it is now, 11 per cent died.

Cellulitis of the neck (angina ludovici) is still a very grave affection, if at all extensive, on account of the danger of œdema of the glottis and pressure on, or infection of, the air-passages. Unless promptly treated, it will usually be fatal.

A cellulitis of the scalp is likely to cause fatal meningitis in some cases; and cellulitis of the arm up to the elbow, or of the leg up to the knee, is a grave condition. If there is black slough, with emphysematous crackling, death will almost certainly take place. Other bad signs are pyæmic abscesses or repeated rigors, delirium at night, or diarrhœa.

An aged, broken-down, or alcoholic person is not likely to recover from a severe attack of cellulitis.

It is very doubtful if antistreptococcic serum saves many cases; but proper evacuation of the seropurulent fluid, hot soaking, and, if necessary, amputation of a limb, are, of course, life-saving procedures. Stiffness of the tendons may be a serious after-trouble of cellulitis of the arm.

A. Rendle Short.

CEREBRAL ABSCESS.—(*See INTRACRANIAL COMPLICATIONS OF EAR DISEASE.*)

CEREBRAL EMBOLISM AND HÆMORRHAGE.—(*See STROKES.*)

CEREBRAL TUMOUR, MEDICAL. (*See also CEREBRAL TUMOUR, SURGICAL.*)—Once the diagnosis of intracranial tumour has been established, the prognosis must always be extremely grave. The duration of life, however, varies within the widest limits. Some patients die within a few days or weeks after the first appearance of symptoms, whilst others survive for two or three years, or even for ten or twenty, though this latter is uncommon. The danger of sudden terminal coma, with death from respiratory paralysis, has always to be borne in mind; and although this termination may occur in tumours situated anywhere within the cranium, it is specially likely to happen when the growth is subtentorial in position. Tumours of the cerebellum, pons, and medulla are therefore relatively more dangerous than those of the cerebrum or those situated in the anterior or middle fossa of the cranial base. Frontal tumours have the longest survival period, as a rule. Sudden death may sometimes occur from spontaneous hæmorrhage into a soft gliomatous tumour, from rupture of an aneurysm, or from a cysticercus suddenly blocking up the aqueduct of Sylvius or the fourth ventricle.

In other cases, however, patients with symptoms of cerebral tumour show long remissions in their symptoms, or even intermissions, lasting months or perhaps years, during which many of the symptoms clear up, ultimately returning again and leading to a fatal termination. It is not uncommon for single symptoms, such as vomiting, visual troubles, fits, etc., to improve whilst the other phenomena persist. Such remissions and variations in the symptoms are partly explained by changes in the tumour itself. Sometimes a tumour changes its main direction of growth, so that parts of the brain which were originally directly compressed are, as it were, pushed aside, and are no longer directly attacked. In other cases the tumour undergoes degenerative changes; or it may for a time cease to grow. Radium emanations in suitable doses applied through the scalp (preferably after a decompressive craniectomy has been done) sometimes induce cicatrization of inoperable gliomata. In others, again, a cystic growth (e.g., cysticercus) may undergo absorption of its contents. In still other cases, where a comparatively small growth obstructs the downward current of cerebrospinal fluid through the ventricles, distending them and producing symptoms of severe intracranial pressure—if the growth slightly alters its position, the ventricular outflow is again established and the acute symptoms subside. In some such cases of internal hydrocephalus, due to pressure from intracranial growths, the cerebrospinal fluid may even find an exit through the cribriform plate at the roof of the nose, and produce a rhinorrhœa affording a spontaneous outflow for the dammed-up fluid, with a corresponding improvement in the symptoms. If a nasal discharge of this sort ceases, the symptoms of intracranial pressure return at once.

Spontaneous cure of intracranial tumours is so rare as to be beyond the bounds of practical prognosis. It occurs now and then, however, in certain aneurysms, which become filled with blood-clot and then undergo obliteration. In certain parasitic cysts (e.g., cysticercus and echinococcus), the parasite may die and the cyst undergo absorption or calcification. Probably the least uncommon variety of spontaneous regression of an intracranial tumour is in the case of solitary tuberculomata, which may undergo partial absorption and calcification. Lastly, under the influence of antisymphilitic remedies, syphilitic gummata may undergo absorption and cure, provided that the syphiloma is still in the stage of cellular proliferation, and without degenerative or sclerotic changes; in the latter case, a gumma will resist even the most energetic medicinal treatment.

Intercurrent complications, rather than direct intracranial pressure by the tumour itself, may be the cause of death. Thus, respiratory complications are not uncommon, especially in the form of inhalation-pneumonia; or a patient with a tuberculoma may have fulminating meningitis superadded; or he may die from miliary tuberculosis.

J. Purves Stewart.

CEREBRAL TUMOUR, SURGICAL. (*See also CEREBRAL TUMOUR, MEDICAL.*)—Four recent publications have thrown a great light upon the end-results of operation for this condition; these are the report by Tooth of the figures for the National Hospital, Queen Square; von Eiselsberg's account of the Vienna cases; the figures for Johns Hopkins Hospital published by Heuer and Dandy; and Cushing's book on his personal experiences of surgery of the tumours of the cerebellopontine angle.

Prognosis apart from Operation.—In the main, of course, the outlook is very gloomy, and the great majority of cases, after intolerable headache, blindness, mental impairment, various forms of paralysis, epilepsy, etc., die in the course of six months to five years. But to this generalization there are important exceptions. The duration may be, and often is, much longer than that described. Many cases are on record in which symptoms of tumour lasted for ten or more years. Tooth, for instance, has found amongst the patients with cerebral tumour discharged from the National Hospital in Queen Square, London, fifty-one who were not operated on, but have survived, on an average, about seven years. About seventy others did not reply, and many are probably dead. In estimating the prognosis, therefore, the length of time that has elapsed since symptoms were first noticed, up to the date of examination, is very important.

The location also is important. Tumours below the tentorium are always liable to cause sudden death by blocking the foramen magnum. Many cerebellar 'tumours' in children are tuberculous, and may lead to fatal tuberculous meningitis at any time. On the other hand, in adults, tumours of the cerebellopontine angle and of the cerebellum may be innocent; and Tooth reports eighteen cases living, on an average, six years after the onset of symptoms.

With reference to the possibility of cure, it is of course feasible to remove a gumma by early and efficient treatment with mercury and iodides; but there is a tendency to relapse, perhaps in some other part of the nervous system, and the scar may lead to paralysis, loss of sensation, or epilepsy.

Apart from these cases, there are a fair number of instances known in which symptoms, apparently diagnostic of cerebral tumour, have ceased to advance, or even more or less completely disappeared. Some of these were probably cases of serous meningitis (Osler), and a similar confusion may arise in connection with growths of the spinal cord.

The prognosis in individual cases must be founded principally upon the rate of progress of the symptoms up to the time of examination, and the diagnosis as to the exact nature and location of the growth. Signs of urgency, calling for operation if life is to be saved or made tolerable, are rapidly increasing blindness or optic neuritis, respiratory or cardiac distress, drowsiness or dullness, and intractable severe headache. In tumours of the nervus acusticus or cerebellopontine angle, interference with swallowing or phonation means an advanced growth and a very bad anæsthetic risk.

Prognosis when treated by Operation.—It is only a minority of the cases that are suitable for any attempt at radical removal. Bruns could only attack 30 out of 100 cases seen by him, and only three or four of these were permanently cured. At the National Hospital for the Paralyzed and Epileptic, out of 497 patients with cerebral tumour, only 111 were treated by removal of the tumour (about a fifth). As both these series would probably include cases sent up specially for operation, the proportion amenable to surgical removal in ordinary practice may be even less.

Operation Mortality.—Three operations have to be considered—decompression, exploration, and removal of the tumour—and also the question whether there shall be one or two stages.

Decompression.—The mortality of this procedure is not negligibly small. In von Eiselsberg's series, 6 out of 28 died within a month; at Queen Square, 29 out of 80 were fatal in the same length of time. At the Johns Hopkins, 15 cases diagnosed as cerebral tumour were decompressed; none died. Of 9 cases diagnosed as cerebellar tumour, 2 died (22 per cent). If the patient survives, the results are usually very satisfactory in cases where there is a real rise of intracranial pressure, both in relieving headache and in saving the sight. Heuer and Dandy found 14 cases improved and 8 no better (10 out of 15 cerebral and 4 out of 7 cerebellar were improved). Cerebral hernia may give trouble afterwards if the dura is opened. The eventual fatality from the continued growth of the tumour cannot, of course, be averted, though it may be postponed.

Exploration.—The mortality of exploration at Queen Square was also heavy, 25 out of 74 dying within a month; in von Eiselsberg's series, 16 died out of 35. The death-rate, then, is about 40 per cent.

Removal of the Growth.—In the Queen Square series, 31 out of 111 died within a month; and in Vienna, 25 out of 100; so that the mortality was about 25 per cent.

The more recent Johns Hopkins figures are better : of 27 cases of cerebral tumour, 7·4 per cent died ; and of 11 growths in the posterior fossa, the death-rate was 18 per cent. The danger is least with tumours of the cortex, and greatest with those of the cerebellopontine angle ; in the latter case, more than half die. Better results can undoubtedly be obtained by a more careful selection of cases, and adoption of the best technique. Cushing has reduced his mortality-rate for tumours of the auditory nerve to 14 per cent. He lays great stress on the order of appearance of the symptoms. The most favourable type is that in which nerve-deafness is the first sign, then headache, then later, facial paralysis, and finally cerebellar signs and optic neuritis. This orderly march of symptoms indicates a fibroma arising on the nerve, and not a diffuse malignant growth of the cerebellopontine angle.

The causes of death are shock, cardiac or respiratory failure—which may come on a week or two after the operation—septic meningitis, and occasionally pneumonia. Most of the extirpations (all in von Eiselsberg’s series) were done in two stages. Of 168 cases at Vienna, 17 died as a result of the first stage.

ONE-STAGE OR TWO-STAGE OPERATIONS.—A two-stage operation has the advantage that shock is reduced, but the drawback of increasing the risks of sepsis. Krause, reporting 154 cases operated on by himself between 1901 and 1913, cites : 21 one-stage operations for removal of tumour—65 per cent died ; 133 two-stage operations, after first stage (decompression) 21·8 per cent died ; 104 two-stage operations, after second stage (extirpation) 34 per cent died.

End-results.—Turning next to the end-results of operation, it will be observed that about a third of the cases at Queen Square, treated by extirpation of the growth, were alive and well some months or years afterwards ; but by no means all these were free from danger of recurrence. In von Eiselsberg’s series, of 168 cases operated on, only 16 are described as cured, and 23 as improved, giving a total of only about a quarter of the whole. Kuttner’s series is unduly favourable, in that cases of hydrocephalus and serous meningitis are included.

RESULTS OF OPERATION FOR CEREBRAL TUMOUR.

I.—Tooth’s Series, National Hospital for Paralyzed and Epileptic.

Region	Cases observed	All operations		REMOVAL (partial or complete)			EXPLORATION		DECOMPRESSION	
		Cases	Per cent	Cases	Died in a month	Alive and well*	Cases	Died in a month	Cases	Died in a month
Frontal -	96	70	73	31	9	13	17	5	22	7
Central -	65	54	83	30	1	9	14	4	10	2
Temporal -	47	30	64	7	1	4	14	1	9	5
Occipital -	14	7	50	2	0	0	3	0	2	0
Corona radiata	13	6	46	1	1	0	2	1	3	1
Pituitary -	14	4	28	4	1	0	0	—	0	0
Cerebellum -	74	33	44	11	4	4	14	5	8	2
Extracerebellar	44	36	82	24	13	7	1	1	11	7
Pons -	41	4	10	—	—	—	1	1	3	0
Various -	49	18	—	1	1	—	7	7	10	5
Not localized -	40	3	7	—	—	—	1	0	2	0
Totals -	497	265	53	111	31	37	74	25	80	29

* ‘ Alive and well ’ includes some cases where there is no recent report.

In the Johns Hopkins series, of 38 patients operated on, 14 are described as cured, 15 as improved, and only 5 as no better ; that is, the operation was worth while for 76 per cent of the patients. Probably this means that there was a more rigorous selection of the best risks than at Vienna. Heuer and Dandy advise that before the dura is opened the lateral ventricle should be tapped to reduce pressure and consequent bulging.

It must be remembered, however, that considerable temporary relief is often afforded to cases that recur and die later. Innocent tumours, of course, show far better end-results

than the commoner sarcomata and gliomata, which almost always recur. It is seldom that removal will be successful if the symptoms have progressed rapidly before operation. Tooth, on the authority of the Queen Square results, advises that the surgeon should not

II.—*Von Eiselsberg's Series, Vienna (1901-1913).*

Location and Operation		Cases	DIED			END-RESULTS			Lost sight of	
			Within a month	Later		Cured	Better	No better		
				Recur- rence	Pro- gress					Inter- currence
Cerebrum	Extirpation of growth -	41	9	10	—	1	9	6	3	3
	Ligature of angioma -	2	—	—	—	—	0	1	0	1
	Incision of cyst	3	—	1	—	1	1	0	0	0
	Died of first stage -	6	—	—	—	—	—	—	—	—
	Tumour not found -	23	9	—	9	—	0	2	2	1
Pituitary Body		16	4	—	—	—	0	12	0	0
Cerebellum	Extirpation of growth -	5	1	3	—	—	0	0	1	0
	Incision of cyst	3	—	—	—	—	3	0	0	0
	Meningitis serosa -	3	—	—	2	—	0	0	1	0
	Died of first stage -	9	—	—	—	—	—	—	—	—
	Tumour not found -	12	7	—	3	—	0	2	0	0
8th Nerve	Large*	11	10	—	—	—	1	0	0	0
	Small*	4	1	—	—	—	2	0	0	1
	Died of first stage -	2	—	—	—	—	—	—	—	—

* Larger or smaller than a nut.

III.—*Kuttner's Series (1907-1912).*

Total operations, 72; mortality, 30·5 per cent; tumour removed successfully in 22 cases. Of the 22 patients, 9 were alive three to six months after operation; 5, one to two years after; 4, two to three years after; 2, three to four years after; and 2, four to five years after.

Functional Results.—Of 22 cases, 10 are completely cured and back at work, but only 4 of these were true tumours; the others were cases of hydrocephalus, serous meningitis, etc., with symptoms resembling tumour. Sight was restored to normal in 75 per cent.

IV.—*Heuer and Dandy's Series, Johns Hopkins Hospital.*

	Cases operated on	No. of operations*	Operation mortality per cent	Case mortality per cent	End-results		
					Well	Improved	No better
I. <i>Extirpations</i> :							
a. Tumours of cerebrum and brain stem - - -	27	32	6·2	7·4	8	13	4
b. Of posterior fossa - -	11	13	15·4	18	6	2	1
II. <i>Decompressions</i> :							
a. Cerebral tumour - -	15	17	0	0	0	10	5
b. Cerebellar tumour -	9	9	22	22	0	4	3

* It will be observed that some of the patients had more than one operation.

attempt to remove red or purple diffuse growths, probably glioma or sarcoma; nor yellow gelatinous or cystic degenerating gliomata, which become active if interfered with. Nor should he attack subcortical swellings, with the exception that cysts may be tapped. If

the patient survives the operation, the best results are obtained in cases of tumours of the auditory nerve, which are usually innocent. Allen Starr finds records in the literature of 69 cases 'cured' (up to three months) out of 162 operated on; 1 was well after twelve years. These figures include all growths of the cerebellopontine angle, not only the acoustic fibromata. Glioma of the cerebral cortex is exceedingly likely to return; only one of the London cases was apparently cured.

Unfortunately, after the removal of tumours of the cortex, patients may be left with hemiplegia, aphasia, or mental impairment, if the Rolandic area or speech centres were involved.

Summing up, we find that only about a fifth of the cases diagnosed as cerebral tumour are suitable for removal; that a fourth of these will probably die of the operation; that, of the survivors, about a third will be cured, another third improved, and the remaining third will be no better, or will die of recurrence. Thus, of 100 cases, 20 are extirpated, 5 die of the operation, 5 are cured, 5 improved, and 5 no better.

Nevertheless, the headache and loss of sight are so distressing, that von Eiselsberg quotes Horsley with approval in the dictum that "it is inhuman not to operate on a patient with cerebral tumour"; because a decompression, at least, is possible.

REFERENCES.—Tooth, *Rep. of XVIIth Internat. Med. Cong.* Sect. vii, 202; *Practitioner*, 1914, April, 487; Von Eiselsberg and Ranzi, *Arch. f. klin. Chir.* 1913, Sept., 309; Kuttner, *Rev. de Chir.* 1913, 646; Krause, *Rep. of XVIIth Internat. Med. Cong.* London, 1914, Sect. vii, Surgery, Pt. 2, 203; Heuer and Dandy, *Johns Hop. Hosp. Bull.*, 1916, xxvii, 224. A. Rendle Short.

CEREBROSPINAL MENINGITIS.—(See MENINGITIS.)

CERVICAL RIB.—In many cases cervical rib gives rise to no trouble at all; this must be so, because though the condition is usually bilateral, the symptoms are almost invariably unilateral. There are three groups of sufferers: those with pressure on nerve-roots, causing numbness, pain, anæsthesia, or wasting; those with narrowing of the artery, leading to pallor or blueness, and feeble circulation, or even gangrene; and those with a pulsating tumour of the neck. There is said to be a tendency to phthisis, and an aneurysm of the subclavian has been induced. There is no tendency to spontaneous cure, but some improvement may follow rest.

Effects of Removal.—There does not appear to be any mortality, so far, in the recorded cases. In 4 out of 21 operations collected by Eisendrath the pleura was accidentally opened, and Thorburn had the same accident in 2 out of 20 cases; but no serious harm resulted. Personally, I use a posterior incision, which is easy, and I think safer.

End-results.—These are fairly satisfactory, but not invariably so. The writer has seen one patient who was operated on three times by various surgeons; eventually she improved. Of the 21 cases in Eisendrath's series, 2 were no better. Sargent had 1 failure in 29 cases. In Thorburn's 20 patients, pain was relieved in four-fifths, and paralysis in half, of those suffering from it.

Streissler sums up the results as follows: 77 per cent are cured; 13 per cent improved; 10 per cent not improved. Sometimes it is several months before the benefit is felt.

Stopford has recently shown that the nerve symptoms characteristic of cervical rib may be met with in some patients who have no such deformity, the trouble being due to pressure of the first thoracic rib on the lower cord of the brachial plexus. A few of these cases are relieved by muscular exercises to develop the trapezius and so raise the shoulder, but most of them come to operation. Removal of part of the first rib nearly always effects a cure. I have had one quite satisfactory case.

REFERENCES.—Thorburn and others, *Proc. Roy. Soc. Med.* 1913, vi (Clin. Sect.), 113; Eisendrath, *Amer. Med.* 1904, viii, 322; Streissler, *Ergebn. d. Chir. u. Orthop.* 1913, v, 280; Stopford, *Brit. Jour. Surg.* 1919, Oct., 168. A. Rendle Short.

CHARCOT'S JOINTS. (See also TABES DORSALIS.)—There is, of course, no prospect of cure in these cases, but with care the joints may settle down and remain *in statu quo* for years. The writer has seen some excellent results following excision in suitable cases, but this is not lightly to be undertaken, as there is a real danger of suppuration or of non-union. A. Rendle Short.

CHEST, GUNSHOT WOUNDS OF.—(See GUNSHOT WOUNDS.)

CHICKEN-POX.—This is a disease which is but occasionally fatal, and one in which complications but seldom occur. During the eleven months, Feb. 7, 1902, to Jan. 6, 1903, 25,009 cases of chicken-pox were notified in London. There were therefore probably about 27,280 cases during the year 1902. During that year 32 deaths from chicken-pox were registered. Probably in not all of the cases was death strictly due to that disease. But even if it were, the fatality was only 0·11 per cent. Of some hundreds of cases which have come under my observation, I have met with three in which death took place. In one case, a child of ten months, there were laryngeal symptoms, presumably due to vesicles in the larynx, which necessitated tracheotomy; the wound became septic, and fatal bronchopneumonia supervened. The second case was one of varicella bullosa in a child aged one year. The third was a case of so-called varicella gangrenosa, also in a child aged one year. Varicella hæmorrhagica is invariably, and varicella bullosa occasionally, fatal. But both of these varieties of the disease, especially the former, are very rare. Varicella gangrenosa, which is a complication rather than a form of the disease, is more common, and is occasionally fatal, usually through some lung complication. The prognosis depends on the number of pocks which become gangrenous, and the age and physical condition of the patient. Should the larynx be invaded by the eruption—a very rare event—tracheotomy may be necessary, and this is an operation which is always attended by some risk, as in the case mentioned above. *E. W. Goodall.*

CHLOROSIS.—This disease has become very much rarer of late years, probably because of improvements in food and hygiene, better housing, and better conditions at work. Severe cases are hardly ever seen, in Edinburgh at least, and the milder forms are also uncommon. In the average case of chlorosis, complete recovery may confidently be expected in from six weeks to four months.

The greatest obstacle in the way of absolute cure is failure of the patient to persist with the necessary treatment. Symptoms disappear, and the patient's sense of well-being is so greatly increased that she fails to realize that complete health has not been regained. It cannot be too strongly insisted upon that the measure of recovery is not the patient's subjective sensations, or an appearance of health, but an examination of the blood. Any deficiency in the number of corpuscles or percentage of hæmoglobin is to be regarded as a clamant indication for vigorous persistence in treatment.

The reason for this is the great tendency of the disease to relapse. This may occur after complete recovery, but the conditions which arise as the result of incomplete cure make relapse almost certain. The patient has little or no discomfort. Her sense of well-being contrasts strongly with her previous breathlessness, palpitation, and headaches. She may now feel fit for exercise, work, or recreation formerly denied her. This is indulged in, although her blood is not yet a satisfactory medium for maintaining the respiration of the tissues. The deficiency can only be met by increased cardiac and respiratory action, the heart is strained, and in a very short time symptoms become as marked as ever. There is now, however, this important difference: they are not nearly so readily curable.

Another result of failure to attain complete recovery is that the patient becomes accustomed to a condition of health which is short of the normal standard. She becomes easily fatigued, listless, apathetic, even sulky, and often finds little sympathy in her family circle. The more striking symptoms are not so much in evidence, and the result may be that the unfortunate patient's disability is attributed to an ungenerous disposition of mind rather than to a deficiency of hæmoglobin in her blood. This type of semi-invalidism is a common result of 'home' treatment. The occurrence of urgent symptoms or marked pallor leads to the purchase of a box of Bland's pills or of some proprietary preparation of iron. As soon as the symptoms have subsided or the box has been emptied, the treatment, such as it is, stops, and the patient resumes her condition of semi-invalidism. With increasing years this state of affairs may be outgrown, but those cases of chlorosis in women of thirty and even forty years of age which are exceedingly difficult to get well, are mainly recruited from this class.

It may be noted that, in chronic chlorosis, nutrition is deficient at a time of life when

mind and body should be most active. Girls doing mental work are handicapped, so that they fail to profit to the full by education, and, among workers, chances of promotion may be lost during the period of life when they are most likely to present themselves. Over and above all this, such cases fall easy victims to intercurrent disease.

Factors Affecting Prognosis.—

Age.—If the onset occurs at an early age, the illness is more likely to be severe and prolonged than if the first attack takes place at a later age. It may be noted that chlorosis practically never occurs for the first time after the age of twenty-three or twenty-four, so that when the condition is met with at a later age, it may safely be assumed that it is a relapse or recurrence of a previous attack, and that it will be more difficult to effect a complete cure.

Heredity.—A family history of chlorosis is not necessarily an indication of any special prognostic significance, but if hereditary or family predisposition appears to be a causal factor of greater moment than stress of environment, then prognosis is so much the worse.

Emotional Conditions.—As in other illnesses, the more definitely a removable cause can be ascertained, the greater is the likelihood of cure. The difficulty is that a removal of the cause may not be practicable or possible. An unhappy love affair is proverbially difficult for any outsider to influence, and the most tactful physician is the one least likely to make the attempt to do so. Homesickness is another potent cause of persistence of a chlorotic condition, and its removal, even when possible, may entail too great a sacrifice to be entertained unless the damage to health is very persistent or severe. Emotional conditions of many kinds may be antagonistic to the success of treatment, and in many instances, such as the recollection of a severe fright, they may be very difficult to overcome.

Occupation.—A sedentary or otherwise unsuitable occupation may be the cause of persistence of anæmia, or of relapse after cure. It is often a difficult problem for the physician to advise in regard to an occupation which may be congenial and inimical to health at the same time. Each case has to be judged on its merits. The factors which will have to be balanced are the actual damage to health, the response to treatment, the probability of diminution of the chlorotic tendency as the patient grows older, and the amount of worry, either sentimental or financial, which a change of occupation may entail.

Locality.—A change of neighbourhood may determine the onset of an attack of chlorosis. Curiously enough this effect sometimes follows a change from town or country to the seaside. Such cases readily yield to treatment and speedily become acclimatized.

Marriage.—Chlorosis very rarely persists after marriage, but occasionally does so. Such cases are generally severe. In some instances there is a complete restoration of the blood to normal during pregnancy, and a relapse after the puerperium.

In dealing with chlorosis, the anæmia which is often associated with *illegitimate pregnancy* should be kept in mind. This anæmia may be true chlorosis, but is often secondary.

Effect of Treatment.—Chlorosis is not one of the diseases in which difficulties arise through the claims of alternative lines of treatment. There may be difficulties in the way, but the main indication is quite definite. That indication is the adequate administration of iron. The difficulties which may arise are the persistence of faulty conditions of life, or a disinclination or disability of the patient to take a satisfactory dietary—carbohydrates, largely in the form of biscuits and sweets, being preferred to meat.

In the severer cases, a speedy restoration in health cannot be expected unless the patient is confined to bed. It is our practice to advise every case with less than 60 per cent of hæmoglobin to stay in bed till the percentage is well above that figure; and if we are asked how long the patient will be kept there, we may say three weeks. That period may be extended or shortened as the result of blood examination, but it is a fair average. Even the milder cases mend more rapidly in bed than when they are going about. Amelioration may be seriously delayed by the patient's inability to retain iron. Such cases are not common, especially if rest in bed be insisted on.

Dyspepsia and constipation, when they are met with, may have to be treated before any iron therapy can be persisted in, and the time of cure is of course postponed. Very rarely, even when dyspeptic symptoms have been removed, iron is not well borne, and we may be obliged to fall back on one of the less irritating forms, such as the scale

preparations, or one of the organic combinations. Neither will be found nearly so efficacious as the perchloride, carbonate, or reduced iron. Many of the organic preparations are useless; preparations of hæmoglobin are notably valueless, and, considering the minute traces of iron which they contain, this is not surprising. The great drawback to all organic compounds is their small proportion of iron and their expense.

Not much is gained as a rule by the addition of strychnine and other drugs to the prescription, unless there is some special indication for them. A little arsenic may be of use, when the count of red corpuscles is very low. When a case is complicated by considerable atony or dilatation of the heart, appropriate treatment is of course called for, and the question of prognosis then enters a somewhat wider sphere. We may remark, however, that cardiac atony or dilatation due to chlorosis is in nearly every case a readily curable condition.

The idea that chlorosis depends on constipation is now exploded. Certain it is that chlorosis is not cured by purgatives, although they may play a useful part in its treatment.

The view of Haldane and Lorrain Smith, that chlorosis is due to an increase of blood plasma, has led to a trial of therapeutic measures intended to deplete the body fluids. Purgatives, diuretics, diaphoretics, and hot baths have been tried, but without good result, and the physician has been glad to fall back on treatment by iron. Attempts to influence chlorosis by bleeding, with the view of thereby stimulating the bone-marrow, have been made, but the results have not been satisfactory.

It may be stated that when such measures are tried alone they fail, and when they are tried along with the administration of iron, the ensuing benefit is attributable to the iron.

When iron is reasonably well tolerated and fails to cure anæmia, we may be assured that in 99 per cent of cases the anæmia is not chlorosis, and a revision of diagnosis is called for. Rheumatism, syphilis, and tuberculosis are among the most likely causes of confusion.

Complications.—Any anxiety that is ever occasioned by a case of chlorosis is much more likely to be due to the occurrence of a complication than to the disease itself. A connection between chlorosis and *gastric ulcer* is well recognized, but their exact relationship cannot be said to be well defined. A history of chlorosis in gastric ulcer is exceedingly common, and we have seen the symptoms of gastric ulcer arise in cases of chlorosis under actual observation.

The occurrence of one or more of the symptoms of *exophthalmic goitre* during the course of chlorosis is probably too frequent to be a mere coincidence. Out of a series of 255 cases of chlorosis quoted by von Noorden, 34 showed more than one of the symptoms of Graves' disease.

The complication of outstanding importance in connection with chlorosis is *venous thrombosis*. It occurred in 6 out of 431 cases reported by von Erben, and in 5 out of 230 of von Noorden's histories. The thrombosis may occur in the femoral veins or in the arms, but unfortunately one of the commonest sites is in the cerebral sinuses. The occurrence of the latter is an experience not readily forgotten by the medical attendant. It is one of the catastrophes of medicine, and there is the danger that the symptoms may at first be attributed to hysteria. Nearly all post-mortem records of cases of chlorosis give venous thrombosis as the cause of death.

Intercurrent Affections.—An important aspect of chlorosis is that it increases liability to all forms of infectious disease, and diminishes the patient's powers of resistance to them.

G. L. Gulland.

A. Goodall.

CHOLECYSTITIS.—Cholecystitis may be diagnosed under the following circumstances :—

Acute Suppurative Cholecystitis.—This may occur in connection with gall-stones (*vide infra*), as a sequel of typhoid fever, or apart from any known cause.

In the post-typhoid cases, there are reports in the literature of 21 operations with 8 recoveries. Idiopathic cases are rare, and simulate appendicitis. The prognosis depends entirely on early diagnosis and operation; granted this, the majority recover; otherwise nearly all die.

Cholecystitis without Gall-stones but causing Similar Symptoms.—This is by no means rare, and many of the patients are operated on and drained under the mistaken supposition that stones will be found. According to Stanton, of 98 such cases 46 were cured, 10 much better, 23 rather better, and 19 no better. These results are not nearly as good as in ordinary gall-stone cases. Cholecystectomy would probably give better results; of 14 so treated, 8 were cured, 3 improved, and 3 no better.

REFERENCES.—Stanton, *Jour. Amer. Med. Assoc.* 1911, lvii, 441; Mayo, *Ann. of Surg.* 1906, xlix, 209; Stanton, *N.Y. Med. Jour.* 1918, April, 682.

A. Rendle Short.

CHOLELITHIASIS.—(See GALL-STONES.)

CHOLERA.—The death-rate of cholera varies considerably in different seasons of the year and in various periods of an epidemic. In the Calcutta Medical College Hospital during the eleven years from 1895–1905 it was 59 per cent in 1243 cases, and varied between 66·7 in the first quarter and 46·7 per cent in the third quarter of the year. At the beginning of an epidemic the mortality is considerably higher than at the end: a fact which should never be forgotten in estimating the effect of any given treatment. In South-Eastern Europe the death-rate may be as low as 30 per cent when an epidemic has lost its original intensity.

The above figures represent the mortality before the introduction of treatment by hypertonic salines and sodium bicarbonate intravenously and permanganates by the mouth, since when the mortality in 1467 cases in the Calcutta Medical College Hospital has been only 21·1 per cent. The mortality among Europeans in Calcutta used to be over 80 per cent, but has now been reduced to about 20 per cent. In an epidemic in the Bombay Presidency the mortality has been recorded as having been reduced from 60 to 21·98 per cent by the distribution of permanganate pills. The new treatment therefore allows of the mortality being reduced to about one-third of the former rate.

The mortality in individual cases is mainly influenced by the following factors, the figures being derived from 1388 cases, nearly all Indians, treated by the writer by his new system in Calcutta. The most important factor is the age of the patient, the death-rate being comparatively high, 26·7, below the age of 5 years; lowest, namely 19·2 per cent, between 11 and 40; after which it rises rapidly with each decade, having been 27 per cent between 41 and 50, and 49·9 per cent in Indian patients over 50 years of age, among whom under the former treatment it was no less than 73·7 per cent, fatal uræmia being especially frequent in the later decades. In Europeans, and in Chinese (Duncan Whyte), the death-rate does not rise so rapidly with the age. In Calcutta sex made no difference to the prognosis. On the admission of a patient the blood-pressure and specific gravity of the blood afford the best indications of the severity of the case. Those with no pulse at the wrist and specific gravities of 1067 and over (1056 being the normal), indicating very great loss of fluid from the body, are grave, although under the present treatment 76·6 per cent of them recovered. Other serious signs are rapid respirations, such as forty or more per minute, cyanosis, great restlessness, and a rectal temperature down to 97° and below, the last having a mortality of 40 per cent. Rapid and repeated recurrence of collapse after hypertonic injections, collapse without the specific gravity of the blood being increased (indicating previous anæmia), vomiting of large quantities of watery fluid, and a blood-pressure persistently below 80 to 90 mm., are all grave signs in the acute stages. In patients admitted with no pulse at the wrist or a blood-pressure below 50 mm. the death-rate was 30 per cent. The prognosis improved in relation to the increase in the average number of saline injections given to the patient, especially the proportion given repeated injections, such as from three to ten in the course of the disease.

The value of hypertonic saline treatment has been confirmed by numerous workers. Thus in India, Rutherford obtained a reduction in the mortality from 62·76 to 23·07, and Sinton from 83·4 to 37 per cent. In China, Duncan Whyte, in two series of 215 and 212 respectively of severe cases with blood-pressures below 70 mm., had mortalities of only 30 and 28 per cent, Cadbury and Hofmann one of 26 per cent, and Logan 23·5 per cent.

In the *reaction stage*, which older writers regarded as at least as deadly as the collapse stage, the chief dangers are severe febrile reaction and continued suppression of urine. In the pre-transfusion days, patients in the Calcutta European Hospital whose temperatures rose during the reaction with returning pulse to from 103° to 106° all died of toxæmia.

After hypertonic salines hyperpyrexia may occur, especially in hot damp weather, and if the temperature is not reduced before the patient becomes unconscious, death always results, although it is usually preventable by timely measures to reduce the fever. Much more frequent and serious is continued suppression of urine, ending in fatal uræmia, occurring either in very severe cases with repeated collapse, or in comparatively mild ones not coming under skilled treatment until two or more days after the onset of the disease and already suffering from anuria for a day or more on admission. If suppression of urine has lasted for two or more days the prognosis is exceedingly grave, especially if the specific gravity of the blood is not increased, showing little loss of fluid. With the hypertonic saline treatment the death-rate from uræmia was 11·1 per cent among 592 cases; but the addition of 2 per cent bicarbonate of soda to the first pint of each saline transfusion has reduced it in 584 cases to 3·25 per cent, or a fall of 70·7 per cent in the uræmic mortality, while Sellards had previously obtained a great reduction of uræmic deaths by the same measure in the Philippines, for with a normal saline solution he had a mortality in 78 cases of 62·84 per cent, including 12 deaths from uræmia, but after adding bicarbonate of soda he lost only 1 case of uræmia out of 77, and his total mortality fell to 41·5 per cent. Goff and Denny, also in the Philippines, with a normal alkaline saline had a death-rate of 27·5 per cent.

Lowell in pregnant patients lost 45 per cent of 66 cases, against a mortality of 19 per cent in non-pregnant females; but when he removed the foetus—which is almost always dead—as early as possible, his mortality in 11 pregnant patients fell to 2, or 18 per cent.

Greig found that patients showing an early development of agglutinins in their blood recovered, while in fatal cases this change was very slight or absent.

Complications.—Pneumonia is a serious late complication, with a very high case-mortality; but in Calcutta it is only responsible for 2 per cent of the mortality in cholera, although more frequent in colder climates. Sudden heart failure in apparently convalescent patients, due to too early and sudden sitting up in bed, accounted for $\frac{1}{2}$ per cent of the deaths. Septic complications are predisposed to by the low state of cholera patients, especially if acidosis is present, but the alkaline treatment has lessened its incidence. Cholecystitis with clinical symptoms occurs in about 2 per cent, but is very rarely fatal. Suppurative parotitis is seen in 1 per cent of cases, but is usually amenable to early incision, though it may produce death if neglected, and in very exhausted patients. The prognosis is much worse in opium eaters and in opium smokers (Duncan Whyte), especially with regard to uræmia.

Leonard Rogers.

CHOREA.—The prognosis is mainly concerned with childhood, although the occurrence of chorea in adolescence and in adult life is thoroughly recognized.

It is interesting to notice in an out-patient department the manifestations that rheumatic children show when they are first brought to a hospital, and the result gives a rough practical idea of the relative frequency of the important ones.

Thus in 500 cases, 248 suffered from arthritis and arthritic pains, 350 from morbus cordis, 245 from chorea, 137 from sore throat, and 39 showed nodules.

A recent analysis of 172 cases of acute rheumatism, all in-patients at the Hospital for Sick Children, gave the following results: chorea was the prominent symptom in 104 cases, and was the solitary lesion in 33 of the 84 first attacks of rheumatism. None of these cases died from chorea; but so severe was the outbreak that of the 172 cases of rheumatism, 22 died, and 30 became complete invalids within fourteen months.

It should be added that all cases of chorea were looked upon as rheumatic, an error probably on the safe side.

Chorea is much more frequent in the female; of 284 consecutive cases, 202 were females and 82 were males; and in a more recent analysis of 104 cases, the proportion was 3 females to 1 male.

This manifestation is very seldom directly fatal in childhood. Of the many hundreds that the writer has seen, only 2 have died from the severity of the movements, though some others have been desperately ill. This experience is confirmed by the recent statistics of Abt, who in 226 cases of chorea saw only 1 case fatal from the violent movements. So far, then, as the first problem in prognosis—the outlook for the particular

attack—we may with confidence feel that it is good—a warning, let it be added, not to over-drug these patients.

The duration of an attack is most uncertain. We may collect statistics and arrive at some such average time as six to eight weeks, but to apply any average to a particular case is as likely as not to result in failure. Abt found that the time in hospital of average cases varied from six to eight weeks.

The liability to relapse is great, and there is a group of cases which seems to develop annually a fresh attack over a period of years. Of special interest is the fact that these attacks seem to come on almost spontaneously.

The prognosis of chorea is intimately bound up with that of heart disease, for 217 consecutive cases showed obvious signs of organic heart disease in 122. Two points will, however, be emphasized here.

Firstly, that recurrent chorea should always put us on guard for the development of mitral stenosis; secondly, that chorea, if severe, is a very grave event when there is also severe carditis.

When severe chorea develops at the height of a pericarditis, a fatal issue is frequent. In 20 fatal cases of acute cardiac rheumatism in which chorea was a prominent symptom, 14 died in their first attack, and in every case there was pericarditis. Conversely, when, during a severe chorea, acute carditis develops, the prognosis is always grave.

There are some cases of chorea in which perfect recovery is extremely slow, and it is doubtful whether, for some years, the child can be really said to be quite natural in its movements. Such cases may have exacerbations once or twice each year, and they may be called examples of chronic chorea. Eventually they appear to get well, although the improvement is so gradual that it is difficult to define when the recovery occurs.

The mental condition in some of these cases is considerably altered, and the writer has known several of them looked upon as mentally deficient. Children with chorea are often exceedingly unstable and emotional long after the movements have ceased; and if in addition there has been practically no education, there is no doubt that the standard of intelligence in the most chronic cases is much lowered, and very possibly permanently damaged. As a rule, in ordinary cases, the intelligence is good, although the mental balance is always weak in the children who are the victims of severe chorea; and in rare cases, with an unsatisfactory mental history in the family, there may be for many months a condition of mind which is so close to aberration as to give rise to considerable anxiety.

We must remember that there are rare cases of tuberculous meningitis in which movements indistinguishable from rheumatic chorea occur; the prognosis in such is, of course, hopeless.

Mental delusions and hallucinations that occur in some cases pass away, so also does dumbness.

In adult life, the predominance of chorea in the female still holds good, and the disease is more severe and certainly more fatal, although such an event is decidedly rare. The Guy's records quoted by Herbert French showed 3 deaths in 29 consecutive cases, a much higher proportion than occurs in childhood. The mental changes in the adult are likely to be more prominent than in the child, and may result in an actual dementia lasting for a considerable time, and some of these patients are indeed very close to the border of insanity.

It must be remembered that chorea may sometimes begin at a very early age. The writer has had three cases in which the condition developed under three years of age. In all the very young cases he has seen there has also been cardiac disease, a point of great prognostic importance.

The duration of an attack depends to some extent upon the mode of onset. The most acute cases in childhood often recover the most quickly; the more chronic ones may linger on for months.

The writer believes that a point of considerable importance in the prognosis of chorea, upon which more information is needed, is the influence of present educational methods. He looks upon chorea as a slight meningo-encephalitis, and, if this is correct, it is evident that a school routine, necessarily based upon the assumption of healthy scholars, may cause an injurious strain in cases of incipient chorea. The problem is a difficult one; but it is clear that many rheumatic children of the poor attend school in a state of ill-health

and mental irritability—children who among the well-to-do would be at once kept at home or sent to a quiet country house, and be freed from all mental exertion.

Do any drugs alter the prognosis? That careful and rational treatment improves the outlook is undoubted, but there seems no one drug that has yet been discovered which produces a certain curative action. On the other hand, the prognosis may be made much less favourable by reckless treatment. Severe arsenical neuritis is a terrible addition to the burden of the illness; salicylate poisoning, or death from overdosage with chloral, are tragic events, but not unknown happenings. Chloretone may produce alarming symptoms in childhood if given incautiously, but the intoxication is a passing one, and to this extent has little effect upon the prognosis.

So far as the writer can ascertain, a good deal will depend, in the question of prognosis, upon the adaptation of the line of treatment to the individual and to the phase of the illness. Exceedingly severe physical and emotional storms, if treated with arsenic, will not derive benefit, but are assisted by nerve sedatives. A combination of the salicylates and bromides seems helpful to early rheumatic cases. Arsenic aids recovery when the temperature is normal, but the nervous system is obstinately unstable. Rest and absolute quiet—indispensable in the early stages—are often, towards the end of a long case, much inferior to cheerful, sensible company, and orderly exercises.

E. and W. H. Mayer have stated that they have obtained remarkable results with the intravenous injection of ten minims of 1 per cent phenol solution, repeated daily for three days. There is not at present sufficient evidence upon this method to enable one to make any alteration in the general prognosis. More recently intrathecal methods of treatment have been introduced. Goodman has used the serum of the patient who is suffering from the attack of chorea. In 30 cases (18 females and 12 males) 20 were cured, that is were 'well' within a week; 7 were markedly improved within two weeks, and only 2 were not benefited. Brown, Smith, and Phillips with the same method obtained 77 per cent cures and in 19 per cent improvement. These are very remarkable results, and one awaits their confirmation in further series of cases, with interest not devoid of anxiety. The writer has no doubt as to the results of these methods on prognosis. If they come into general use without the most searching criticism and perfect technique, chorea would then become a disease dangerous to life. Porter discarded auto-sera for horse serum and arsphenamine, and speaks well of this combination in very severe cases.

It cannot be too much insisted that, so far as children in this country are concerned, chorea is not often fatal; and in the writer's opinion the prognosis will be improved by inquiry into educational methods and into the causes of rheumatism. The prognosis in Huntington's chorea, or chronic progressive chorea, is apparently hopeless, and that of senile chorea very grave. Some senile cases have recovered after months and even years, or remained stationary but in fair health. Those that have recovered have been treated on general principles and with nerve sedatives such as are used in the chorea of childhood.

F. J. Poynton.

CHORION-EPITHELIOMA MALIGNUM.—No new growth shows greater variations in malignancy than this. There are cases of extreme virulence in which death occurs within a few days or a month from the onset of symptoms, with widespread metastases. At the other end of the scale, cases of complete cure are known in which operation was only performed after a year had elapsed since the onset of the first symptoms. Another remarkable point is that a radical operation performed after the appearance of metastatic growths may be followed by a cure and disappearance of the metastases. Chorion-epithelioma is the only example of a malignant growth in which spontaneous disappearance or healing of metastases has been observed. The growth is disseminated through the veins, and Teacher¹ has shown that hæmorrhage and thrombosis around the tumour-nodules are important factors in their destruction by cutting off their blood-supply and provoking increased tissue-reaction. Three extraordinary cases are quoted by Teacher,¹ in which a primary uterine tumour as well as metastases were present, yet in which spontaneous cure occurred without radical operation. Histological examination of the primary uterine growth may be of assistance in making a prognosis; generally speaking, the cases in which chorionic villi are found in the tumour are less virulent than those in which only epithelial elements are found. There is evidence which suggests that cases following upon hydatidiform mole are less virulent than cases following normal

pregnancy or abortion; but a probable explanation of this is that patients who have had a hydatidiform mole are more likely to be kept under observation subsequently, which will lead to early diagnosis and operation. Further, the microscopical examination of a mole may reveal malignant characters and lead to prompt operation in the early or pre-malignant stages of chorion-epithelioma or in border-line cases.

Results of Operation.—The statistics of the cases collected by Teacher¹ and published by him in 1903 showed that, out of 100 patients submitted to operation, 63 recovered and 37 died, a percentage of 63 of immediate recoveries. Of the 37 deaths, 12 occurred within a few days, and these may be ascribed to the weakened condition of the patient at the time of operation, or to the occurrence of severe hæmorrhage on the attempt being made. Of the 63 recoveries, 32 were reported well six months or more after the operation, and out of this number 24 remained well for more than a year, and of these again, 13 were reported well more than two years after the operation. So far as the follow-up results of these patients went, the conclusion seems justified that if the patient survives more than six months without signs of recurrence, the probability of permanent recovery is considerable, after one year it is very great, while cases in which two years have elapsed may be regarded as absolute recoveries.

The interval which has elapsed between the onset of symptoms and the performance of a radical operation is not a reliable guide to prognosis. Of 82 cases in which data were available, in the 50 recoveries the interval was four and a half months, and in the 32 fatalities was four months. It seems probable that the best clinical guide to the degree of malignancy is the interval which elapses between the termination of the last pregnancy and the appearance of the first symptoms; in a large proportion of the most malignant cases the symptoms have appeared during or shortly after the puerperium.

Chorion-Epithelioma of the Fallopian Tube.—The cases which appear to have originated in the Fallopian tube are, as might be expected, more serious than in the case of the uterus. In the first place the difficulty, almost the impossibility, of diagnosis, and in the next place the early dissemination which occurs, both militate against a favourable outlook.

Bazy² has collected 12 cases, with the following results to the patients: 2, not operated on, died; of the other 10, who were operated on, 5 died soon after operation, 4 lived from two to four months, 1 was cured. In one case the growth was only the size of an early tubal gestation, for which indeed it was mistaken at the time of operation; nevertheless the patient died in a few weeks with extensive metastases. In contrast to this is the case recorded by Phillips,³ who removed a chorion-epithelioma of the left tube, and operated later for metastases, removing the uterus and right appendage, but leaving behind a mass at the root of the mesentery which he took to be metastases in glands; yet the patient recovered and was well two and a half years later.

REFERENCES.—¹*New System of Gynecology* (Eden and Lockyer), 1917, ii, 555; ²*Ann. de Gynéc. et d'Obst.* 1913, April; ³*Jour. Obst. and Gynecol. Brit. Emp.* 1911, ii, 299. Eardley Holland.

CIRRHOSIS OF THE LIVER.—(See LIVER, CIRRHOSIS OF.)

CIRRHOSIS OF THE STOMACH.—(See STOMACH, SURGICAL AFFECTIONS OF.)

CLEFT PALATE.—In spite of the publication of several very important series of cases, well followed through and treated by various methods, we are still without reliable information on some necessary points. It would be very valuable, for instance, to have data for judging the mortality amongst cleft-palate babies in the early years of life, before the age at which it has been customary to operate. Sir Arbuthnot Lane claims that many lives are saved by closing the palate during the first few weeks after birth, because so many of these children would otherwise die, but this opinion is unsupported by figures and is open to grave doubt.

Further, we do not know whether children, whose palates have been closed by a flap-operation, will eventually be able to speak well. At the exhibition of cases treated by various methods at the Royal Society of Medicine in 1911, very few of those shown by the advocates of this procedure were old enough to talk, and their mouths showed a good deal of scarring in many cases, so that it was open to question if the very essential mobility of the soft palate would be obtained.

On other points, however, we are now in possession of very excellent data. Four methods of treatment come up for discussion ; (1) *Langenbeck's*, or the ordinary operation ; (2) *Lane's* turn-over flap method ; (3) *Brophy's* operation ; and (4) the *Obturator* method.

1. **Langenbeck's Operation.**—Provided that care is exercised in the choice of time of operation, so that the child is in good health when it is performed, the immediate danger to life, in patients two years of age or older, is extremely small. Berry reports 154 cases without a death.

The prospect of *closure of the gap* is good. Berry says that he has never seen a cleft which could not be closed by operation, provided that the parts had not been spoiled by a previous failure. In his list of 138 first operations, there were 109 in which complete union took place, or the hole left was only big enough to admit a probe and would probably close spontaneously. In 25 cases success was partial or a hole remained ; some of these were cured by a second operation. In 4 cases there was complete failure ; some of these also were remedied subsequently. It must be admitted that not many surgeons could produce so high a percentage of successes.

Second operations gave 13 successes and 3 partial successes.

The end-results as regards *speech* depend on many factors : the age at operation, the length and mobility of the soft palate, the intelligence of the child, and the care in after-training. In Berry's tables, the speech was investigated at least a year later in 97 cases. It is described as good in 36 ; good, but certain letters still gave trouble, in 21 ; and fair or poor in 40 ; in many of these last there was very definite improvement, others were mentally defective, and the great majority had no proper training.

LANGENBECK'S OPERATION (BERRY).

	Cases	Deaths	UNION			SPEECH		
			Complete or virtually complete	Partial	Failure	Good	Fairly good	Fair
First operations -	138	0	109	25	4	36	21	40
Second operations	16	0	13	3	0	3	3	7

The end-results of second operations were not so good ; out of 13 followed, 3 spoke well, 3 had trouble with certain letters, and 7 were only moderately improved.

2. **Lane's Flap Operation.**—At the meeting of the Royal Society of Medicine in 1911, the principal exponents of this method were Sir Arbuthnot Lane, Hilton Fagge, and one of the former's house surgeons.

FLAP OPERATION.

	Cases	Deaths in Hospital	Died subsequently
Lane, all cases - -	369	22 (=5·9 per cent)	?
„ first operations— under one year old }	144	18 (=12·5 per cent)	?
Fagge, all cases - -	57		
„ first operations— under one year old }	38	3 (=7·8 per cent)	14 (=37 per cent)

Of Lane's operations, 369 were reported, with a mortality of about 6 per cent. Of these, 144 were first operations on children under twelve months, the majority being but a few weeks old. By this very early interference, such is the argument, shock is avoided, ill-development of the mouth and nasopharynx prevented, and children are saved who would otherwise die of malnutrition. Of these 144 cases, 18 (12·5 per cent) died in hospital. What eventually happened to the survivors is not, as a rule, known.

Fagge reported 57 cases, of which 38 were under one year old. Of these, 3 died in

hospital, and an attempt to follow up the others showed that 14 had died since. It is, therefore, by no means certain that the operation is life-saving; probably the reverse is the truth.

Goyder has operated on 30 cases, all but 3 by Lane's method. He failed to obtain complete closure at the primary operation in 7 cases.

The end-results as regards speech are not known in a sufficient number of cases to justify deductions. In 15 cases investigated by Goyder, speech was good in 4, fair in 4, and poor in 7. Three of the 4 classed as good were still very young, and the final condition remains to be seen.

3. Brophy's Operation.—The essential point in this operation is to force the maxillæ together by stout wires before the child is three months old. By this means it is usually possible to close even a wide gap, the best results being obtained within a few weeks of birth. Brophy claims to have treated 300 cases with a mortality of only 3 per cent, but 5 out of 11 English cases died, and necrosis ensued in another. This operation can only be used when there is a complete cleft of the hard palate.

Ulrich uses a somewhat similar method. He lost 2 out of 10 cases.

4. The Obturator.—It is easy to close the cleft in the hard palate by this means, but it is difficult or impossible to provide a movable soft palate controllable by muscles, and therefore speech is not greatly improved. The obturator is more useful in adults than in young children, who would require frequent changes, and might also get it impacted in the œsophagus.

REFERENCES.—Berry and Legg, *Hare Lip and Cleft Palate*, 1912; *Proc. Roy. Soc. Med.* 1911, iv, pt. 3 (Surg. Sect.), 169; Goyder, *Brit. Jour. Surg.* 1913-14, i, 259.

A. Rendle Short.

CLUB-FOOT.—(See TALIPES.)

COCAINE HABIT.—(See DRUG HABITS.)

COLITIS.—

Simple.—The prognosis is, as a rule, good, provided the condition is taken in hand early. When very exceptionally acute, death may occur from exhaustion, toxæmia, or collapse.

Membranous.—This disease is, as a rule, chronic; however, the majority of patients eventually recover, though some do not appear to be benefited by treatment. The outlook is better in men than in women. The complaint is not in itself fatal. The age of the patient has little influence on the course of the illness, nor has the presence of intestinal sand, which is not uncommon.

Ulcerative.—The outlook is exceedingly serious if the disease is in any way severe, many of the patients dying within the course of the first few months after presenting themselves for treatment. Grave symptoms are high fever, marked distention due to flatus, severe hæmorrhage, copious diarrhœa, exhaustion, and, more rarely, peritonitis. Death may take place in three or four days from the first onset of symptoms, and frequently occurs within the first two months. It must, however, be remembered that many of these patients give a history of previous attacks of diarrhœa, and if the onset of the illness is measured from the first of these, the duration is often many years. On the other hand, life may be prolonged with continuous subacute symptoms for upwards of two years, and in a small proportion of cases permanent cure apparently results from treatment, even when the disease has been very acute and severe. The vast majority of cases run their course either to death or recovery without complications. Though perforative peritonitis may occur, it is much less common than might be supposed when the extensive area of ulcerated surface is taken into account. Hepatic abscess is very rare indeed. Pulmonary embolism sometimes kills. In cases which recover, there is little liability to obstruction of the bowels from cicatrization.

The mortality is higher than in tropical dysentery; thus, death occurred in 40 out of 55 cases treated at Guy's Hospital; 28 out of 32 at St. Bartholomew's; 9 out of 19 at St. George's; 8 out of 19 at St. Mary's; 40 out of 80 at St. Thomas's.

The mode of death in the St. Thomas's Hospital series was as follows: Of 8 children, all died from exhaustion following diarrhœa. Of 32 adults, 9 died from exhaustion

following diarrhœa; 1 from hæmorrhage; 8 from hæmorrhage and diarrhœa; 1 from hepatic abscess; 6 from peritonitis after perforation; 2 from peritonitis without perforation; 5 from peritonitis following closure of an artificial anus.

At the present time there is not sufficient evidence upon which to base a prognosis from the predominant organism present in the evacuations, or from agglutination tests. The sex of the patient does not influence the outlook.

It is questionable whether the use of vaccines materially modifies the prognosis. Improvement and sometimes cure have followed their use at times; on the other hand, they have frequently no effect in arresting the course of the disease or preventing a fatal termination.

J. R. Charles.

COLON, CARCINOMA OF.—Compared with the average rate of growth of cancer elsewhere, carcinoma of the large intestine is not a particularly rapid or malignant type of the disease. It is certainly more favourable than cancer of the rectum. As Paul has pointed out, and contrary to the generally-received opinion, the hypertrophic form, in which a large tumour can be felt, is less rapidly fatal than the stenosing form, which causes chronic or acute intestinal obstruction. The duration of life, from the first onset of symptoms to the end, is usually from six months to two years, apart from treatment. In the great majority of cases the eventual fatality is due to an attack of acute obstruction; less often, to cachexia; and rarely, to perforative peritonitis.

Marked anæmia and loss of flesh, or symptoms of obstruction, show that the end is not far off; but a patient may pull through one or two attacks of partial obstruction.

Results of Surgical Treatment.—The mortality of operation depends very greatly on the state of the patient when the surgeon sees the case; also, to some extent, on the method of intervention. If signs of acute obstruction are already present, the outlook is very grave, and all that can be done at the moment is a short-circuiting or colostomy; but in a minority of cases the patient may recover sufficiently to allow of a subsequent radical operation. Cases with cachexia are already beyond hope of cure, though it may be possible to give some relief.

It is evident on paper, from the figures supplied, that a two-stage operation is decidedly the safer, giving a mortality of about 15 per cent. This refers to cases in which there is no acute obstruction present. By a two-stage operation is meant either Paul's method, in which the growth is resected and a drainage tube tied into each end of the bowel at the first operation, the spur being reduced and the fistula closed subsequently; or a preliminary colostomy, followed by resection and end-to-end union. But the statistics are vitiated by the fact that the worst cases never reach the stage of the second operation.

The best results after the one-stage operation are from the Mayo clinic, where 11 died out of 63 operated on, or 13 per cent; but in Finkelstein's series, including the patients of the Mayos and several other surgeons, the mortality in 209 cases is 29 per cent.

Apart from acute obstruction cases, the mortality is given by various writers as follows:—

MORTALITY OF OPERATION FOR CARCINOMA OF COLON.

Reporter	Operation	Cases	Died
			per cent
*Finkelstein	Two-stage	142	16
Paul	"	14	0
Anschütz	"	30	20
*Moynihan	"	32	15
*Finkelstein	One-stage	209	29
Anschütz	"	20	55
*Moynihan	"	68	32.3
Mayos (year 1919)	"	63	17
*Hartmann	Stages not specified	143	33.5
St. Thomas's Hospital	" "	58	39.5
Voelcker	" "	58	46.5
Caird	" "	17	35.2
Lausanne	" "	28	10.0

* These are cases collected from the literature.

Anschütz's reports refer to cases in von Mikulicz's clinic up to 1907 ; Voelcker's to Czerny's clinic ; Moynihan's tables were published in 1906 ; Finkelstein's relate to the years 1907 to 1912. Very probably several of the series taken from the literature include the same groups. Paul's cases are all from his private practice. The Lausanne series, published by Voichoud, relate to the years 1880-1910. In 19 cases the operation was in one stage. The mortality given by the Rochester, Minnesota, clinic for the year 1919 is rather higher than some of the Mayos' pre-war figures, which they explain as being due to the fact that they now operate on 70 per cent of the cases seen, whereas they used only to operate on 25 per cent.

Sir Harold Stiles declares that the operation can be made much safer by putting a temporary tube in the cæcum to permit the escape of flatus.

End-results of Operation.—These are not unfavourable, provided, of course, that there were no secondary deposits at the time of intervention, and that the glands were removed. It is only of late years that it has been widely recognized that a hard mass of growth in the colon constricting the lumen may be due to other causes than cancer. In the cæcum a tuberculous mass may mimic a malignant tumour very closely, and diverticulitis of the pelvic or other parts of the colon may be indistinguishable except by the microscope. It has occasionally happened, after colostomy, that the inflammatory mass has cleared up altogether. I have seen one such fortunate case. For this reason, the older published end-results in cases of cancer of the colon may be too favourable. Various observers report as follows :—

END-RESULTS OF OPERATIONS FOR CARCINOMA OF COLON.

Reporter	Cases followed	Alive and well	Period
Anschütz - -	27	14	Over three years
Moynihan - -	49*	{ 9	" " "
		{ 22	One to three years
Paul - - -	13†	{ 5	Over three years
		{ 2	One to three years
Lausanne - -	24	{ 6	Over three years
		{ 8	Under three years

* Three deaths were not due to cancer. † Two deaths were not due to cancer.

According to the Mayos, 50 per cent of the patients are alive and well five years after operation, or 70 per cent if there was no glandular involvement. Death from recurrence is often late. In four of Paul's cases it took place from two and a half to seven years after the operation.

Palliative Operations include colostomy above the growth to relieve obstruction, and a short-circuiting operation.

Colostomy, in the presence of an acute obstruction, is, of course, a desperate performance, and frequently the patient does not rally. Of 64 cases in Paul's private practice in which this operation was performed for malignant disease, acute obstruction was present in 24, and 9 of these died soon afterwards. There were no fatalities in the absence of acute symptoms.

The survival afterwards is often surprisingly long, should the patient recover from the immediate effects of the operation. Of Paul's 64 cases, 9 died shortly after the operation ; 28 within a year ; 17 one to three or more years later ; 10 were alive (all for more than a year and up to ten years, except one. Some of these presumably had a resection performed later). It is not quite clear how many of these long-survival cases had a subsequent resection ; at cannot be many, as the total resections for cancer were only 14 in number. Probably cases of diverticulitis are included in this series.

It is a mistake to suppose that these patients were necessarily left in a state of misery. Persons with a colostomy have frequently been able to get about their duties ; a lady has even acted as hostess through a London season, without serious inconvenience, wearing a colostomy belt.

We have no adequate figures to show the risks or successes of short-circuiting operations in cases of cancer of the colon.

To sum up, then, the mortality of the one-stage operation is 30 to 40 per cent ; of the two-stage operation about 16 per cent ; and about half the patients who survive will be cured.

REFERENCES.—Paul, *Brit. Med. Jour.* 1912, ii, 172 ; Moynihan, *Abdominal Operations*, 1906 ; Makins, "Cancer of Colon", *Burghard's System of Operative Surgery* ; Finkelstein, *Arch. f. klin. Chir.* 1913, July, 936 ; Voichoud, *Surg. Gynecol. and Obst.* 1914, ii, 248 (Summary) ; Mayo, *Surg. Gynecol. and Obst.* 1921, xxxii, 97.

A. Rendle Short.

CONCUSSION.—(See HEAD INJURIES ; SPINE, INJURIES OF.)

CONGENITAL DISLOCATION OF HIP.—(See HIP, CONGENITAL DISLOCATION OF.)

CONGENITAL HEART DISEASE.—(See HEART, CONGENITAL MALFORMATIONS OF.)

CONGENITAL STENOSIS OF PYLORUS.—(See PYLORUS, CONGENITAL STENOSIS OF.)

CONTUSIONS, ABDOMINAL.—(See ABDOMINAL INJURIES.)

CONVULSIONS, INFANTILE.—(See INFANTILE CONVULSIONS.)

COXA VARA.—Apart from treatment, the condition usually gets steadily worse, the shortening becoming more noticeable as growth proceeds. Rarely, the rickety form may improve ; Hoffa had a case in which the angle of the femur increased from 105° to 120° on one side, and 110° to 125° on the other, in three years.

Rest and extension check the process, but do not rectify the deformity already present. The best results are obtained by subtrochanteric osteotomy, or better still by Whitman's method, that is, removal of a wedge with its apex at the lesser trochanter. Section of the neck of the femur is risky ; one death from sepsis and two cases of necrosis of the severed head are recorded.

In many cases coxa vara is the end-result of an untreated case of slipped epiphysis of the femur, and a heavy responsibility rests upon the medical man in attendance, because if the patient is properly treated by correction of the deformity within a few days of the accident, a perfect result can be obtained and lifelong crippling averted. It ought to be remembered that if the neck of one femur gives way, the other is very likely to follow suit.

REFERENCE.—Tubby, *Deformities, including Diseases of Bones and Joints*, vol. i.

A. Rendle Short.

CRETINISM.—(See MENTAL DISEASES.)

CYSTITIS.—(See PYELOCYSTITIS ; BLADDER, TUBERCULOSIS OF.)

CYSTS, PANCREATIC.—(See PANCREATIC CYSTS.)

DELHI BOIL.—(See KALA-AZAR.)

DELIRIUM TREMENS.—(See MENTAL DISEASES.)

DEMENTIA AND DEMENTIA PRÆCOX.—(See MENTAL DISEASES.)

DENGUE.—(See TROPICAL FEVERS.)

DERMATITIS HERPETIFORMIS.—(See PEMPHIGUS AND PEMPHIGOID AFFECTIONS.)

DIABETES INSIPIDUS.—This name is applied to cases in which very large quantities of urine are passed without any signs pointing to disease of the kidneys. Little is known of the nature of the malady, though attempts have been made to differentiate certain types—*hydruria*, *polyuria*, *azoturia*, *phosphaturia*.

Hydruria or Polyuria.—This common form of the disease occurs chiefly in children, and more often in those of the poor. The condition may arise suddenly or gradually. No certain prognosis can be given until the course of the case has been carefully observed. Some cases continue for many years without giving rise to inconvenience, beyond the frequent micturition ; others terminate fatally within a few months. A sudden onset is more favourable than an insidious invasion, as the condition may subside as suddenly as it appeared ; cases of this kind associated with injuries to the head have the most hopeful outlook ; those which follow some shock are also likely to recover.

Chronic cases, with insidious onset, and accompanied by wasting, loss of appetite, dryness of the skin, and increasing weakness, are likely to end fatally within five or six months; those, however, which cause no symptoms may last long, sometimes exhibiting acute exacerbations and comparative remissions. Children of tuberculous parents usually do badly; those presenting signs of a syphilitic taint may recover on appropriate treatment. In a certain proportion of cases, diabetes mellitus supervenes and proves fatal, while tuberculosis of the lungs may be the cause of death, as in the latter malady.

Several different methods of treatment have been proposed, in comparatively recent years, which cause the general outlook in these cases to be better than formerly. One of these is the withdrawal of salt from the dietary, on the ground that the malady consists in an inability of the kidneys to excrete this substance except in extremely dilute solution, an enormous flow of water being thus necessitated. A connection has also been traced between diabetes insipidus and disturbance of the pituitary body, and the use of preparations of pituitary substance has seemed to modify the disease. It is stated that cases marked by infantilism, with headache and contracted visual fields, may be treated with an extract of the anterior lobe of the pituitary body; cases with obesity, drowsiness, and, in females, amenorrhœa, with extract of the posterior lobe. The skull may be skiagraphed to endeavour to find evidence of alteration of the sella turcica. This method of treatment is, however, in its infancy, and nothing certain is known of its results.

Azoturia.—Examination of the urine may show the continued passage of increased quantities of urea, the condition being usually accompanied by languor and aching in the loins, and sometimes by increased appetite as well as thirst. These cases generally do well if treated early by rest, change of scene, and hydrotherapy (Carlsbad, Homburg). If neglected, the condition may pass into one of saccharine diabetes, or emaciation may supervene, and gradual or sudden death.

Phosphaturia.—In some instances, which clinically resemble the above, the amount of phosphates contained in the urine is increased even more markedly than the urea. The patients are irritable, and suffer from digestive disturbances. The treatment is similar to that just described, and, if taken early, these patients do well.

REFERENCES.—Bradford, in Allbutt and Rolleston's *System of Medicine*, vol. iii, p. 212; Jewitt, *Med. Record*, 1914, 242.

W. Cecil Bosanquet.

DIABETES MELLITUS.—The true nature of diabetes, and its relationship to other forms of glycosuria, are still unknown, so that for practical purposes they must all be considered together. No useful distinction can be drawn between persistent glycosuria and mild diabetes mellitus, and from time to time apparently mild cases pass into the grave affection. With a view to prognosis, it may be most convenient to sketch the course of a few typical cases of varying severity, and then to endeavour to indicate points which may be used to assign individual patients to one or other group.

Typical Varieties.—

1. *Alimentary Glycosuria.*—A young or middle-aged man, feeling out of sorts after a copious meal accompanied by many 'sweets', is examined by a doctor, and the urine is found to contain sugar. On the following day, this has disappeared. A similar experience subsequently, or a test-administration of glucose, proves him to be the subject of alimentary glycosuria. With a little care in avoiding dietary indiscretions, he remains free from any disturbance of health.

In addition to this form of alimentary glycosuria, there are a number of cases of transient glycosuria which hardly amount to disease, and constitute no danger to life or health in themselves. Thus, closely allied to the alimentary form, but by some classed as a renal glycosuria, is the condition often seen in pregnant women, whose urine may from time to time contain small quantities of sugar (apart from their well-known lactosuria) which disappears after delivery (*see below*). Eaton and Woods state that similar glycosuria is common in infants.

A form of glycosuria apparently associated with disorder of the liver, but possibly rather to be assigned to coincident pancreatic disturbance, occurs in alcoholic subjects. Quite large amounts of sugar may be present in the urine for a considerable period of time; yet, on cutting off the supplies of intoxicants, complete recovery may take place. A somewhat similar recovery may occur in syphilitic subjects as a result of suitable treatment

(mercury, iodide, salvarsan). It is wise, therefore, to withhold a definite opinion in regard to such persons until a suitable regimen has been adopted, and continued for some months.

2. *Renal Glycosuria*.—In this condition there is found a constant small amount of sugar in the urine, but the quantity present in the blood is not increased. There appears to exist an undue permeability of the renal cells with regard to sugar. The affection may appear in several members of a family, and is usually harmless; but it is stated that acidosis and even coma may at times ensue.

3. *Chronic Glycosuria (Chronic Diabetes)*.—A middle-aged man of sedentary habits, engrossed in business anxieties, stout of build, and with gouty tendencies, is found to suffer from glycosuria. On strict diet the sugar disappears, but the patient cannot tolerate strict dieting. On a diet containing a moderate amount of starchy materials he continues to pass 2 to 5 per cent of sugar, but suffers no apparent inconvenience, living to a fair age, and ultimately dying of cerebral hæmorrhage or arteriosclerotic heart failure.

4. *Diabetes of Moderate Severity*.—A middle-aged man notices that he is losing flesh and strength, while his urine is increased in quantity and he is unusually thirsty. On being questioned, he admits that he has not been well for the past year, and that the symptoms have gradually developed. The urine is found to contain a moderate amount of sugar. On a strict diet this gradually falls in amount and finally disappears, and it is ascertained that a small amount of carbohydrate can be allowed without the return of glycosuria. On a restricted diet he remains well for some months, but the glycosuria returns and a still more limited diet is necessitated. Later still, no reduction of carbohydrates is found to be efficient, and the urine always contains a considerable quantity of sugar. The patient perhaps suffers from itching of the skin, or from boils and pustules. Finally acetone and diacetic acid appear in the urine, perhaps accompanied by albumin and casts, and the patient dies comatose after an illness of seven or eight years.

5. *Acute Diabetes*.—A boy, age ten to fourteen years, suffers from thirst, hunger, polyuria, and increasing weakness, all of which symptoms have arisen within the period of a week or ten days. When seen by the doctor, he is weak and drowsy, with a flushed face, and a red tongue covered on the dorsum with thick fur. His breath smells of acetone, and this substance, together with diacetic acid and glucose, is present in the urine. On a diet containing a limited amount of carbohydrate, aided by doses of liquor morphinæ and administration of sodium bicarbonate, in drachm doses, by the rectum, he improves: the drowsiness passes off, the acetone bodies disappear from the urine, and the sugar diminishes in amount, but does not disappear. On careful diet the boy remains comparatively well for six months, when the former symptoms return, to yield once more to treatment. A second period of comparative health is followed by a second relapse: treatment is ineffectual, air-hunger is noticed, and increasing drowsiness, deepening into coma and death. The whole illness has extended to a little over eighteen months from the first onset of symptoms.

Grouping together the cases which are usually classified as diabetes mellitus, no general rules as to probable duration can be laid down. Feilchenfeld found that, of 154 cases, 30 per cent lived over ten years after recognition of the malady. Hornor and Joslin found that some 26 per cent lived ten years and over, and 11 per cent for fifteen years. Over 20 per cent of their cases lived longer than the 'expectation of life' according to insurance tables at the time they came under treatment. The shortest case which I have found recorded is that of a girl of seventeen, who developed acute diabetes after typhoid fever and died in eleven days (Laache). Chronic cases may last over thirty years. It will be convenient to consider *seriatim* the various factors which influence the prognosis.

Factors Influencing the Prognosis.—

Age.—As a general statement, it may be said that the younger the patient the worse is the outlook. In infants and young children the course of the disease is very rapid—seldom more than twelve to eighteen months. It is doubtful if recovery ever takes place in established cases, but Mason Knox, who collected 16 cases occurring within the first year of life, states that he found records of 2 recoveries. In rather older children, a similar brief course is common. In young adults the outlook is scarcely better, a fatal termination almost invariably ensuing within two or three years; but cases of glycosuria are found among them from time to time, the condition passing off and leaving no ill effects, so that a bad prognosis should not be given immediately owing to the mere discovery of sugar

in the urine. In those over twenty-five the course is likely to be less rapid, and the patient may live seven or eight years if carefully looked after. In subjects over forty the course of the affection is usually much more prolonged, a duration of ten to fifteen years being common. Acute cases are, however, to be encountered at almost all ages.

Sex.—The outlook does not appear to be strikingly different in the two sexes; but cases occurring in women about the climacteric are said to be specially amenable to treatment. It seems likely that they are often instances of glycosuria due to disturbance of internal secretions coincident with ovarian atrophy.

Obesity.—Diabetes or glycosuria occurring in fat persons usually runs a slow course, often without much apparent disturbance of health, though various complications may be present from time to time. Hence the French have classified the disease into two forms, *diabète gras* and *diabète maigre*, the latter being the dangerous form. Hornor and Joslin found that cases of long duration (10–15 years) were met with only among stout diabetics. Such patients often exhibit gouty symptoms, and perhaps more often die from arteriosclerosis or uræmia than from coma—the typical diabetic ending. They are also liable to cerebral hæmorrhage.

Social Position.—There is no doubt that persons who are well off and thus able to carry out a strict régime of diet and mode of life, are more favourably placed than the poor, who cannot afford luxuries in the form of starch-free foods, rest, climatotherapy, and so forth. Acute rapidly fatal cases are rare among the upper classes. Cases in middle-aged persons of business habits, associated with some degree of worry and anxiety, often do well when these causes are eliminated by rest or retirement.

Family History.—In a considerable number of cases, other members of the patients' families have suffered from diabetes. Some idea as to the probable severity or chronicity of the case may be gleaned from what has happened to the others; but no great reliance can be placed on such evidence, as some cases in a family may be grave and others comparatively mild.

Onset.—An acute onset with severe symptoms is of bad omen, whereas a gradual increase, with periods of improvement or quiescence, points to a likelihood of a long course, but such a rule is far from absolute. Some instances which follow an acute infective disease yield readily to treatment, while mild cases may develop into severe ones: this, however, according to von Noorden, is rare, at all events if patients submit to strict regimen. Cases associated with head injuries may completely recover; they should probably be called glycosuria rather than diabetes.

Symptoms.—Great thirst and increased appetite point to severe diabetes, but the absence of these symptoms does not necessarily imply that the affection is of mild type; indeed, loss of appetite may be a bad sign if it has previously been large or moderate. Wasting is rapid in grave cases, and it is useful to weigh the patients regularly every week, as much information as to progress or retrogression may be thus obtained; a patient who is gaining weight is usually doing well. Constipation is usual, and may be difficult to treat, but does not necessarily affect the outlook. On the other hand, diarrhœa is a bad sign, and, if intractable, is often found to be a forerunner of coma. Severe epigastric pain is another warning signal which should not be neglected. Drowsiness may precede actual loss of consciousness by some days, and should always excite alarm. The smell of acetone in the breath may be the first warning of the grave intoxication which is accompanied by the presence of acetone bodies in the urine, but regular examination of the urine will always show the presence of traces of these substances in this secretion before it is noticeable elsewhere. It may be worth noting that acetonuria may be found apart from diabetes mellitus (cyclical vomiting of children, etc.), but it is always of serious import.

The Urine.—The continued passage of very large quantities of urine is usually a sign of grave disease, and diminution in the amount passed is often an early sign of improvement. Very large amounts of sugar are also bad, but it cannot be said that the severity of the case is directly proportional to the saccharin output; this varies with the diet taken and with other factors. Thus, the sugar may be much diminished, or actually disappear, just before the onset of coma; so that such an occurrence in the presence of grave symptoms is an alarming sign. In chronic senile cases the percentage of sugar and its total amount are usually small. In the presence of intercurrent infective disease (*see below*), the sugar may diminish or disappear from the urine. The most important consideration

in connection with the urinary sugar is the effect of restricted diet in reducing the quantity excreted. The usual procedure, in respect to cases seen for the first time, is to estimate the quantity of sugar passed for two or three days on a normal diet, and then gradually to reduce the amount of carbohydrate food, substituting such materials as casoid bread, gluten, saccharin, etc., for the ordinary bread, potatoes, sugar, etc., taken. When all starchy food has thus been withdrawn, the quantity of sugar in the urine is again estimated on three successive days. If no sugar is found, then small amounts of bread or potato are added to the diet until sugar once more appears. In this way the carbohydrate tolerance of the individual is estimated. If some 120 gm. of carbohydrate can be taken in twenty-four hours without the appearance of sugar in the urine, the case is a mild one, and the patient is likely to live for many years. If, on the other hand, no carbohydrate can be taken without glycosuria, the disease is likely to be serious, and if no restriction of diet causes disappearance of the sugar, the state of affairs is manifestly grave. (It need hardly be noted that, in all cases here dealt with, the sugar in question is glucose. Pentosuria is apparently a family or hereditary abnormality of metabolism, and is of no importance from a health point of view). Repetition of similar tests of tolerance during the progress of the case will indicate improvement or deterioration, according as the quantity of carbohydrate duly assimilated is greater or less than at first. In most cases the degree of tolerance tends to fall as time goes on.

The urine should be tested from time to time for the presence of acetone and diacetic acid. The ferric-chloride test for the latter is simple, and usually sufficient for practical purposes, as the two bodies are generally present together. If they are found, the aspect of the case immediately assumes a graver character, as it evidently belongs to the class of severe diabetes and is likely to terminate sooner or later in coma. It must not, however, be assumed that this is imminent, for acetone bodies may appear and disappear for considerable periods without fatal issue. A definite increase in the excretion of acetone and diacetic acid is a cause for anxiety, especially if the patient tends to be drowsy, or the quantity of sugar diminishes concurrently.

The appearance of any considerable amount of albumin in the urine is of bad omen, though small quantities may be found from time to time in chronic gouty cases without any serious effects resulting. If large numbers of casts are also found, the condition is serious, as this phenomenon often shortly precedes the fatal issue. The arteriosclerosis which accompanies renal disease is responsible for a considerable number of deaths among diabetic patients owing to the occurrence of cerebral hæmorrhage. Estimation of the ammonia-content of the urine is also of value in prognosis, any large increase in the normal quantity being associated with acetonuria, and being an indication of approaching coma.

The Skin.—In diabetes this is usually dry: the occurrence of a tendency to sweat has been said to be a good sign, but it would be unwise to lay any stress on such a point. Pruritus seems to be more common in chronic cases, especially in gouty subjects. Boils may be troublesome, but are not often of serious import. On the other hand, a large carbuncle is sometimes a grave complication and may give rise to fatal septic intoxication and coma.

Pigmentation of the skin in association with glycosuria is sometimes classed as a separate disease, *hæmochromatosis*, or *bronzed diabetes*. The features are rather those of cirrhosis of the liver, a condition usually found in these subjects after death, which is generally due to intercurrent disease rather than to coma. The glycosuria may sometimes disappear while the other symptoms continue. The duration of the condition, after the phenomena have become well marked, may be from two to three years, but some patients may succumb within a few months.

The Blood.—The estimation of the quantity of sugar present in the blood has now been adapted to practical laboratory conditions and is of considerable importance. The quantity present in normal blood is approximately 0.1 per cent. In chronic diabetics it may rise to 0.3 per cent. If it is over this amount, the case must be looked upon as serious. Examinations of the lipid content of the blood have also been carried out, and it is found that all the constituents of this group are present in increased quantities in diabetes (fatty acids, lecithin, cholesterol), fatty acids rising for example from the normal 0.37 per cent to 0.8 in chronic cases, and higher in severe instances. Such rise points to severe disease, but the prognostic value of such determinations is not accurately known.

Nervous System.—Loss of knee-jerks is commonly noticed in diabetes, and seems to be of no special importance as an indication of the severity of the disease. Neuralgia is a frequent trouble, especially in elderly subjects, but does not influence the general prognosis. It usually yields to rest in bed and regulation of the diet. Most of the sensory disturbances in diabetes are associated rather with vascular degeneration than with true peripheral neuritis, which is a rare complication. (*See also MENTAL DISEASES.*)

Coma.—Until recent years, the prognosis of diabetic coma was absolutely hopeless, patients invariably dying within a comparatively small number of hours after the condition originated. Even now, the outlook is so far desperate that a fatal termination to the disease is almost certain to ensue before many months after such an occurrence; but in many instances the immediate fatality may be averted by treatment, at all events in the commencing stages of the condition. Recovery is certainly possible from a state of deep drowsiness and practical unconsciousness with the typical symptoms of air-hunger, under the administration of large doses of bicarbonate of soda, either in the form of enemata or by intravenous infusion. The administration of glucose itself by the rectum has also been employed in this condition, which is supposed to result from carbohydrate starvation. Probably between 40 and 50 per cent of all cases of true diabetes die in coma.

Gangrene.—Dry gangrene in diabetes is due to arterial disease, with consequent deficiency of the blood-supply to the affected part. It is best treated expectantly, the limb being kept dry and, as far as possible, aseptic. The outlook is fairly good under these conditions. If the gangrene is moist, pointing to bacterial infection, amputation is necessary, and the outlook is bad.

Cataract.—The appearance of cataract in an infant or young child is a sign of grave disease and of a rapidly fatal issue. In any acute case, operation is inadvisable. In chronic cases, in which the glycosuria is controlled by dieting, operation is often quite successful; but there is always a danger of local hæmorrhage supervening.

Intercurrent Disease.—Acute infective disease occurring in the course of diabetes is always a source of anxiety, as it may induce fatal coma. This is not, however, at all a necessary sequence, as diabetics may pass through severe illnesses and make satisfactory recoveries; but the prognosis must always be guarded until complete convalescence. The effect produced on the glycosuria is variable. In some instances the sugar disappears from the urine during fever; or diminishes markedly; in other cases it is unaffected, or may even increase. A fatal diabetes may date from an attack of acute disease, such as enteric fever, though it is difficult to make sure that slight symptoms may not have existed previously, and been overlooked until the urine was tested regularly in the course of the infective disease. Pneumonia in diabetics is usually but not invariably fatal, gangrene of the lung being a frequent termination. Erysipelas and other troubles due to pyogenic organisms are also dangerous, owing to the diminished resistance shown by the tissues in these patients. Tuberculosis of the lungs is a common cause of death. It is doubtful if recovery from the infection ever occurs in true diabetics, but its course may be prolonged for two, or even three, years. The sugar often tends to disappear from the urine as the pulmonary disease progresses. In grave cases, a fatal issue may occur in two or three months after signs are noticed in the chest. The prognosis in individual cases will depend on the rapidity of emaciation and on the progress of signs of destruction of the substance of the lungs. There may be fever of the usual hectic type, but in this, as in other infective disorders, cases are met with in which grave infections run their course with little or no elevation of temperature.

Pregnancy.—The relationship of pregnancy to diabetes is not well understood. According to Franck, transitory glycosuria occurs in 40 per cent of all gravid women, and more persistent glycosuria in 10 to 12 per cent. Whitridge Williams believes that if the symptom occurs late in pregnancy, and the sugar is not more than 2 per cent, while there are no symptoms of ill-health, the condition is transitory and unimportant; if it occurs early, or in larger amount, no prognosis should be given till delivery has taken place and the progress of affairs been observed. Diabetic patients may make good recoveries from the troubles of labour, or may die in coma. If the amount of sugar in the urine is large, and uncontrolled by diet, artificial labour should be induced. I have known a case in which glycosuria occurred in one pregnancy, with increased thirst and polyuria, to pass off after delivery, and return again with the next pregnancy, the case then becoming

one of confirmed diabetes. It is certainly necessary to give cautious prognosis in all these cases.

Surgical Operations.—Diabetics may make good recoveries from severe surgical procedures; on the other hand, coma may ensue and prove fatal. This risk makes it wise to avoid all unnecessary operations of a trivial or cosmetic nature; but dangerous conditions, such as appendicitis or cancer, which in themselves threaten life, should be treated without delay. A general anæsthetic, especially chloroform, is to be avoided if possible, local or spinal anæsthesia being preferred. Strict asepsis is of the greatest importance: the mortality of aseptic operations, in Karewski's experience, amounted to 14·7 per cent, that of septic operations to 26 per cent; 11·8 of the former and 21·7 of the latter being due to coma. Shock is also to be avoided by all possible means, and it is wise to reduce the glycosuria by diet, and to administer doses of bicarbonate of soda, before operation. Acetonuria is a contra-indication to surgical interference.

Mode of Death.—The greater number of diabetics die ultimately from coma, this condition occurring in probably 90 per cent of the acute cases. In chronic diabetes this termination is less common, but can never be excluded. The next most common causes of death are tuberculosis of the lungs, which is also more frequent in young subjects with severe disease, and arteriosclerosis with its various complications (cerebral hæmorrhage, uræmia) among the old patients. Other causes of death are septic infection, as from carbuncle or erysipelas, gradual cardiac failure of arteriosclerotic type, and a peculiar form of sudden, or almost sudden, cardiac failure, possibly due to involvement of the myocardium. In some cases in which the symptoms of coma are present, the patient, nevertheless, retains actual consciousness until the end.

REFERENCES.—Eaton and Woods, *Arch. of Pediatrics*, 1911, xxvii, 905; Feilchenfeld, *Zeits. f. Versicherungsmed.* 1912, v, 33; Franck, *Arch. f. exper. Pathol.* 1913, lxxii, 387; Hornor and Joslin, *Amer. Jour. Med. Sci.* 1918, clvi, 47; Laache, *Med. Klinik*. 1910, vi, 503; Lapersonne, *Presse méd.* 1910, xviii, 89; Karewski, *Deut. med. Woch.* 1914, No. 1; Whitridge Williams, *Amer. Jour. Med. Sci.* 1909, cxxxvii, 1; Williamson, *Practitioner*, 1911, lxxxvi, 821. W. Cecil Bosanquet.

DIARRHŒA, INFANTILE.—A simple non-inflammatory diarrhœa is very much less serious than an inflammatory diarrhœa due to *enterocolitis*. In this latter condition, high fever, constant vomiting, marked tenesmus, loss of elasticity of the skin, drowsiness, collapse, grave nervous symptoms associated with convulsions, are to be regarded as of the greatest gravity.

Convulsions are of more serious import when they occur during the stage of exhaustion and collapse, than when they occur at the onset of the disease. Purpura is a very grave sign; so also is the complete absence of sleep. Children who develop dyspnœa of the 'air-hunger' type nearly always die. The outlook is worse in children under one year of age than in older children.

The prognosis depends very largely on the previous health of the child, e.g., whether or not it is the subject of rickets, also on its surroundings, and the season of the year. Any other disease, such as whooping-cough, adds greatly to the gravity of the case.

Pulmonary catarrh with collapse of alveoli and bronchopneumonia not infrequently arise during the illness, rendering the outlook still more serious. If the temperature in the rectum reaches 105° the prognosis is very bad, or if it runs up with a sudden leap from the normal to any great height. Exposure to chill during the height of the attack is very likely to produce an exacerbation of all the symptoms.

Summer Diarrhœa (Cholera Infantum).—In this complaint the prognosis is based on points similar to those mentioned above (enterocolitis). The younger the patient (*cæteris paribus*), the worse the prognosis.

In the more chronic diarrhœas of children, the incidence of œdema of the extremities is a sign of grave import, and so also is the onset of thrush in the mouth. J. R. Charles.

DILATATION OF THE STOMACH.—(See STOMACH, MEDICAL AFFECTIONS OF.)

DIPHTHERIA. — The most important factors which govern the prognosis of this disease are: (1) *The age of the patient*; (2) *The site of the disease*; (3) *The severity of the attack*; (4) *The occurrence of certain complications*; (5) *The treatment*.

1. Age of Patient.—The following table, based on 56,507 cases of diphtheria treated

in the hospitals of the Metropolitan Asylums Board during the years 1900 to 1909, shows the importance of age as a factor in the case-mortality :—

FATALITY ACCORDING TO AGE.

Age	Fatality per cent	Age	Fatality per cent	Age	Fatality per cent
0-1	34.0	0-5	15.7	25-30	1.3
1-2	22.7	5-10	8.3	30-35	1.3
2-3	16.4	10-15	3.4	35-40	4.0
3-4	13.4	15-20	1.8	40 and over	5.0
4-5	11.2	20-25	0.9	All ages	10.3

From this table it appears that the disease is much more fatal in children than in adults, and that, up to twenty-five years of age, the younger the patient the greater is the risk to life. The large majority of these patients were treated with antitoxin. *Sex* appears to have no influence on the fatality.

2. Site of the Disease.—The most common sites are the *fauces*, *nasal passages*, and *larynx*. The false membrane may be found on all these parts simultaneously, or may be limited to one of them. The more intimately adherent the false membrane is to the mucous surface, the more surely will absorption of toxin take place and toxæmia and its sequels occur. Now the false membrane is almost invariably attached very loosely to the nasal passages and to the larynx and trachea. Hence toxæmia is seldom pronounced and is often absent in nasal and laryngeal diphtheria if the fauces are unaffected; and it is the faucial form of the disease which affords the most striking examples of toxæmia. Diphtheria of the air-passages is, however, the most fatal of the three varieties under discussion, because of the mechanical obstruction to respiration to which it gives rise by occlusion of the larynx, trachea, or bronchi.

In adults, invasion of the air-passages may be overlooked until involvement of the small bronchi gives rise to dyspnœa, and it is then too late to save the patient by operation. Aphonia, therefore, even without dyspnœa, is a grave sign in an adult. Fortunately the air-passages are seldom attacked in adults.

Simple nasal diphtheria is seldom fatal. The most serious cases are those in which the nose, throat, and windpipe are simultaneously involved.

An estimate of the influence on prognosis of the involvement of the larynx may be derived from the statistics of the Asylums Board already quoted. During the ten years 1900 to 1909, the fatality of cases in which the larynx was not affected was 8.8 per cent; whereas in those in which it was affected (with or without involvement of the fauces) the fatality was 18.9 per cent.

Of other forms of diphtheria, the *vulval* and *cutaneous* are the most serious, because they are prone to be accompanied by grave toxæmia. In *ocular* diphtheria there is considerable risk of loss or impairment of sight from damage to the eyeball.

3. Severity of the Attack.—Most of the laryngeal cases must be regarded as severe, because of the high fatality amongst them. About half of them come to tracheotomy or intubation, 57.3 per cent at the Eastern Hospital, Homerton, during the ten years 1905 to 1914 (586 out of a total of 1022 cases in which the larynx was involved).

In other forms of the disease, severity depends upon the degree of toxæmia: this, in its turn, depends upon the extent and persistence of the false membrane. Albuminuria may be taken as a rough index of toxæmia; the more lasting the albumin and the larger its amount, the more profound the toxæmia and the greater the chance of the occurrence of some untoward event. Early nephritis (blood and casts in the urine) is a most serious condition: fortunately, it is rare. The following symptoms of toxæmia are extremely grave: repeated vomiting; scantiness of urine; hæmorrhages into the skin and subcutaneous tissue, and also from mucous membranes (unless from the nose only, in nasal diphtheria); an infrequent, feeble, and irregular pulse; an ashen hue of the lips and extreme pallor. In most cases in which one or more of these symptoms are present the patient is evidently ill, even to the unpractised eye; but occasionally, when there is

progressive suppression of urine, with little or no vomiting, he may seem to be doing well, and even to be getting better. Other unfavourable symptoms are a blotchy erythematous rash, usually most pronounced on the extremities; enlargement of the liver; and convulsions.

4. **Complications.**—*Paralysis* is the most frequent, as well as the most important; it occurred in about 16 per cent of the 56,507 cases mentioned above. It usually supervenes after the false membrane has disappeared, and when the patient may appear to have recovered from the attack of diphtheria, commonly during the third or fourth week, and with diminishing frequency up to the seventh. Hence it is important to know what forms of diphtheria it may follow. The lesions which give rise to paralysis are caused by the toxin; so that the more toxic the case, the higher the risk of palsy. In respect of the gravity of the paralysis itself, a fatal issue is the more to be feared the earlier this complication arises and the more rapidly the various groups of muscles are involved. The outlook is grave if any of the ordinary muscles of respiration are affected, especially the diaphragm. Frequent vomiting is a serious symptom. Paralysis is met with much more often in children than adults. Its termination is either by complete recovery or by death; patients are never left permanently paralyzed. About 13 per cent of the cases are fatal.

Heart failure may occur, not only in connection with paralysis, but even in cases in which that complication has not supervened. Like palsy, it is to be anticipated most in the toxic form of the disease. Acute cardiac dilatation, especially when accompanied by precordial pain, is nearly always fatal. Heart failure is prone to occur in patients who have been allowed to get up and about too soon after the false membrane has disappeared.

Lobular pneumonia is the only other serious complication. It is found only in 1 or 2 per cent of the cases, and chiefly in those which have undergone tracheotomy.

5. **Treatment.**—*Antitoxin.*—In cases not treated with antitoxic serum the prognosis is less favourable, *ceteris paribus*, than in those so treated. Amongst the antitoxin-treated cases, those do best which are brought under treatment earliest. Of severe cases which receive the serum late, those have the best chance of recovery in which large doses (20,000 to 30,000 units) are given. The earlier the serum treatment is commenced, the less chance is there of the larynx becoming invaded, and of paralysis supervening. If paralysis does occur in a patient who has been treated with serum early, it is almost always very slight. Convalescence is hastened in those who receive serum treatment at the beginning of the illness.

The following figures, from the 1911 annual report of the Metropolitan Asylums Board, show the case-mortality per cent according to the day of disease upon which the serum treatment was commenced.

FATALITY ACCORDING TO DAY OF COMMENCEMENT OF SERUM TREATMENT.

Day	Cases	Deaths	Fatality per cent
1st day - -	149	4	2·6
2nd „ - -	911	31	3·4
3rd „ - -	981	88	8·9
4th „ - -	707	89	12·5
5th „ and over	1116	150	13·4
Total	3864	362	9·3

Operation (Tracheotomy and Intubation).—In respect of recovery after tracheotomy, the prospect has very much improved since the introduction of the serum treatment. Whereas about 30 per cent used to recover, about 70 per cent are now cured. In some hospitals intubation is practised, usually to the partial exclusion of tracheotomy. It is impossible to compare satisfactorily the results of intubation with those of tracheotomy.

because of the lack of parallel series of cases which can be fairly set against each other. During the ten years 1905 to 1914, 586 cases of laryngeal diphtheria were submitted to operation at the Eastern Hospital, and of these 156 died, a fatality of 26·6 per cent. These cases can be arranged as follows:—

FATALITY AFTER OPERATION.

Operation	Cases	Deaths	Fatality per cent
Intubation only -	295	28	9·4
Intubation followed by tracheotomy	159	74	46·5
Tracheotomy only -	132	54	40·9
Total -	586	156	26·6

It will be seen that 35 per cent of the intubated cases came to tracheotomy. The fatality of all the cases operated upon, viz., 26·6 per cent, compares favourably with the fatality, about 30 per cent, of the tracheotomy cases at those hospitals in which intubation was not practised.

The patient who is intubated recovers much more quickly than the patient who is submitted to tracheotomy.

The most favourable ages for tracheotomy and intubation are from 3 to 9 years. The prognosis in adults is very grave.

If a patient is intolerant of the intubation tube, and coughs it out frequently, tracheotomy should be performed: irritability of the larynx is prone to be followed by ulceration. But if membrane is coughed out with the tube, even though the latter is frequently expelled, resort should still be had to re-intubation until the membrane has disappeared. The longer the intubation tube is worn, the more likely is ulceration of the larynx to be set up. It has been my practice as a rule not to leave the intubation tube in the larynx for longer than twelve days, and I have seldom met with ulceration of that organ due to the tube.

E. W. Goodall.

DISSEMINATED SCLEROSIS.—The causation of this disease is undetermined as yet. The characteristic patches of sclerotic overgrowth of glia are secondary to an antecedent degeneration of the medullary sheaths. Why the medullary sheaths themselves should become degenerate is at present unknown. There is much to be said in favour of a microbic origin for the malady, but until the organism and its toxin are actually identified, our treatment must remain frankly symptomatic.

Early diagnosis is of great importance. If we can recognize the disease in its earliest stage, we save the patient from misdirected treatment. Thus, for example, some cases of disseminated sclerosis are mistaken for cerebrospinal syphilis, and are subjected to long and futile courses of antisiphilitic medication. Others are mistaken for tabes or other varieties of ataxia. Others, again, mistaken for cerebellar or cerebral tumour, have even been submitted to exploratory operations. Most frequently of all, the remittent course of disseminated sclerosis causes it to be mistaken for hysteria; and the patient is consequently stimulated by encouraging suggestions to try and ‘throw off’ her malady by an effort of will, and to undertake exercises of a fatiguing kind which probably hasten the progress of the disorder.

The duration of the disease is uncertain. At the outset it should be remembered that, by itself, it is rarely fatal. The commonest course is a chronic one lasting for years, with occasional periods of remissions or arrest, during which marked improvement takes place, followed, after variable intervals, by further relapses. The remissions may amount to apparent cure. The longest remission with which I am acquainted occurred in the case of a woman who, at the age of twenty-three, had her first symptoms of the disease, consisting in complete paraplegia, with loss of sphincter control, and with central

scotoma due to retrobulbar neuritis; she recovered from this in six months. Three years later, she had another attack of visual trouble, with weakness of the right leg, lasting several months. She married at the age of twenty-nine and had four healthy children. For many years she led an active life, apparently in ordinary health. At the age of fifty-three—i.e., twenty-seven years after her second attack—she again became weak in the right leg, and within three years developed the classical signs of disseminated sclerosis, including motor weakness, intention tremors, and the characteristic changes in the reflexes. At the age of seventy-one—i.e., forty-eight years after the first onset of the disease—she was still alive, although the limbs were severely paralyzed and ataxic. Nevertheless she was able to get up to dinner daily, and to go out driving.

The next most common variety of the disease is that in which the symptoms, after slowly or rapidly attaining a degree of moderate severity, remain more or less stationary. The patient, although suffering from motor weakness and perhaps confined to bed, remains well nourished; and the general health is fairly well sustained, it may be for many years, until at last a final exacerbation of the disease occurs.

A third variety is met with, where the patient has a series of attacks or exacerbations, consisting in transient blindness, diplopia, monoplegic or hemiplegic attacks, etc., clearing up in part, but leaving him in the intervals more and more paralyzed, each fresh exacerbation lowering the general level of strength, until the patient becomes bedridden, with contractures, sphincter trouble, etc. In such cases, careful attention is required to prevent cystitis and bed-sores, either of which complications may lead to a terminal toxæmia. Intercurrent pulmonary complications, tuberculous or pneumonic, may also prove fatal. Bulbar paralysis, from the presence of a sclerotic area in the medulla, is a less common cause of death.

To sum up, then, the prognosis in disseminated sclerosis, as regards cure, is unfavourable; but, as regards duration, long remissions may occur, especially if physical or mental strain is avoided. In the later stages, when the patient has become bedridden, the duration of life depends on assiduous nursing, prevention of bed-sores and bladder infection, and avoidance of pulmonary and other complications.

The patient with disseminated sclerosis is not infrequently somewhat emotional, with a tendency to smile and laugh on slight provocation; but in uncomplicated cases there is rarely, if ever, any true intellectual deficiency. This fact is sometimes of importance with regard to testamentary capacity.

J. Purves Stewart.

DISLOCATIONS.—(See JOINTS, INJURIES OF.)

DRUG HABITS.—(See also MENTAL DISEASES.)

Opium.—Children are much more susceptible to the influence of opium than adults, but among the latter there is a great personal factor as far as susceptibility is concerned. In acute poisoning, a cyanotic or ashy face covered with clammy sweat is of extremely grave, but not necessarily fatal, significance. If copious vomiting takes place before stupor sets in, there is a good chance of recovery. It should be remembered that in the comatose condition, false appearances of improvement may occur which are very deceptive, the patient again relapsing into a fatal coma. A patient who has taken a toxic dose cannot be considered out of danger for twenty-four hours. Since death generally supervenes as the result of failure of respiration, an improvement in the depth of this, and in the colour of the skin, should be carefully looked for. Dilatation of the pupils during deep coma, following on their contraction, is of the gravest import. About 5 gr. will kill most people, but a man has died after $1\frac{1}{4}$ gr. of the extract, and a small child after $\frac{1}{10}$ gr. of opium.

Morphia.—In morphinism, much depends on the length of time the patient has been under the influence of the drug, and the dose taken. As much as 75 gr. has been tolerated by chronic morphinomaniacs in the course of twenty-four hours. It is probably more difficult to break the habit in patients who take the drug hypodermically than in those who take it in any other way. As in opium-eating, there is a very marked personal element in the amount which can be tolerated. Young people can stand larger doses over more prolonged periods without gross cachexia appearing than can the more elderly. The latter are liable to feel the effects of the withdrawal of the drug in a greater degree. Chronic morphinomaniacs do not live to an old age, and are very liable

to be carried off by an attack of some relatively mild acute disease ; or if they escape this, they pass into a condition of extreme asthenia and emaciation, and die from sheer bodily debility.

During treatment, the great danger is that of inducing a fatal collapse by too sudden withdrawal of the drug, while there are frequently periods, after cure has been apparently obtained, during which the patient suffers from intense craving for morphia ; the craving is less severe and not so constantly repeated as in the case of alcoholism or cocaineism. These periods of craving may, however, recur for eighteen months to two years after the cure. As small a dose as $\frac{1}{8}$ gr. has proved fatal. A large dose of morphia may prove fatal in half an hour, but the majority of patients live from six to twelve hours.

Heroin.—This is not a harmless drug, for a habit may be induced which, in severe cases, presents as much difficulty in escaping from as does the escape from the opium habit. Moreover, the patients may remain physical wrecks, with undermined constitutions and of no resisting power, even when they have been cured of their habit.

Cocaine.—The prognosis of chronic cocaineism is worse than in the case of morphinism, because the patients have no desire whatever, in the great majority of cases, to be delivered from their habits, and have a very great tendency to relapse immediately they are liberated from restraint. There is a greater destruction of the higher mental faculties than in the case of morphinism, and if possible the patients are even more inveterate liars. This renders treatment more difficult and prognosis worse. With the onset of marked emaciation, sunken eyes, tremors, hallucinations, and delusions of persecution, the prognosis is well-nigh hopeless. It produces destruction of its victim more quickly than opium or alcohol. Delusional insanity may develop very rapidly in chronic cocaineism, and the delusions may remain for weeks after the drug has been entirely withdrawn. There is a strong personal idiosyncrasy to the effects of the drug. While $\frac{2}{3}$ gr. have proved fatal, there seems to be no definite limit to the amount which can be taken without producing immediate death in those who take the drug as a habit.

Chloral.—Full tolerance is not obtained even though the habit of taking this substance may have lasted for a long time. The great importance of this is that the usual dose, or even a smaller dose than usual, may be followed by a fatal result. The same remark holds good with reference to chloroform. In some cases the patients drift into a condition of melancholia, while in others a state resembling delirium tremens may supervene.

Sulphonal.—The repeated ingestion of sulphonal may lead to very serious symptoms, because the drug has a cumulative action, being excreted slowly from the body. A dangerous sign is the onset of hæmatoporphyrinuria, evidenced by the appearance of red, pink, brown, or almost black urine. This danger is more marked in women than in men. When given continuously, sulphonal may produce sudden coma and death, but more often there are other warning symptoms such as hallucinations, mental confusion, exhaustion, nausea, tympanites, abdominal pain, cyanosis, coldness of the extremities. These may be followed by death from exhaustion in some cases.

If any of these symptoms arise, the use of the drug must be stopped immediately ; but all danger is not then passed. Serious symptoms have arisen for the first time as long as nine days after the cessation of the administration of the drug.

Trional and Tetronal may produce the same grouping of symptoms, including hæmatoporphyrinuria, if given over a prolonged period. A large single dose is not likely to produce them, as much as 120 gr. of trional having been taken without the onset of hæmatoporphyrinuria.

J. R. Charles.

DUODENAL ULCER (*see also* STOMACH, SURGICAL AFFECTIONS OF).—Remembering that in many cases an ulcer of the duodenum is entirely latent as far as any manifestation is concerned, it is impossible to say how many get well unrecognized. Of those diagnosed, perforation is stated to occur in about 40 per cent, while more or less severe hæmorrhage arises in from 30 to 40 per cent. In different series the mortality-rate from hæmorrhage has varied from 13 up to 36 per cent. The possibility of complications, which include abscess (e.g., subphrenic), subsequent stenosis of the duodenum, stenosis of the common bile-duct, and secondary malignant disease, must be borne in mind in giving a prognosis. Relapses in duodenal ulcer occur with about the same frequency as in gastric ulcer.

J. R. Charles.

DYSENTERY.—There is no disease, or rather group of diseases, in which the death-rate differs so widely, chiefly in relation to the nature of the infection and the stage in which the patient comes under treatment. Thus, among many thousand cases coming early under observation in India, the mortality in a series of years varied from 0·51 per cent in the Indian Army and 2·93 per cent in British troops to 5·29 in Indian gaols. On the other hand, in a large Calcutta hospital where many chronic and often moribund cases are admitted, in the course of five years the death-rate was no less than 40 per cent, the cases being fairly evenly divided between the bacillary and the amœbic forms. The importance of differentiation between the different forms of dysentery having only recently been at all generally recognized, accurate data regarding the mortality of amœbic and bacillary dysentery respectively are scanty. During the war the bacillary form of dysentery was usually the more prevalent form.

Mortality of Bacillary Dysentery.—When this form is epidemic, as occurs in Japan, the mortality is high, such as 30 per cent, but can be much reduced by the use of anti-dysenteric serum. In chronic neglected cases, as among the Mecca pilgrims at the El Tor camp in Egypt, the death-rate was no less than 64·4 per cent (Ruffer and Willmore), but was reduced by a polyvalent serum to only 10·8 per cent. Among similar cases in native patients in a Calcutta hospital, the mortality was between 30 and 40 per cent, serum treatment being seldom used on account of the cost. Manson-Bahr in Fiji had a mortality of 13·2 per cent under the saline treatment, but only 1·8 with the use of serum. Extensive data regarding the prognosis, in cases proved bacteriologically to be bacillary dysentery and treated in an early stage, appear to be wanting, but apart from epidemics it would probably be under 10 per cent.

Factors Influencing the Case Mortality of Bacillary Dysentery.—Cases occurring in epidemics or several in a house at one time are usually severe. The most serious form is one accompanied by cholera-like collapse; but hypertonic salines, as now used in cholera, have improved the outlook of such cases. High and prolonged fever is an indication of severe toxæmia requiring serum treatment. Anti-dysentery serum in full doses during the first six to nine days of acute cases shortens the duration and lowers the mortality, but at later periods it is of little value. Fisher has reported 183 cases with only one death. Local peritonitis is a rare but dangerous sign in bacillary dysentery. Perforation, pylephlebitis, and severe hæmorrhage from the bowel are also rare but deadly complications. In cases coming at a late stage, the previous duration of the illness is the most important factor in the prognosis. If the disease has continued for over a month with little abatement, a chronic state with extensive intractable ulceration—especially of the lower half or two-thirds of the large bowel—will be present, which is most difficult to deal with. In this stage bad signs are great emaciation, anæmia, œdema of the feet, hiccough, and exhaustion, with the continued passage of numerous stools. Bacillary dysentery often attacks patients suffering from other exhausting diseases, such as kala-azar, when the prognosis is particularly hopeless. In chronic cases non-toxic sensitized vaccines much improve the outlook. A chronic form of arthritis may follow the disease, and was especially frequent during the South African War, but tends to clear up in time.

Mortality in Amœbic Dysentery.—At the Calcutta Medical College Hospital this disease accounted for one-twelfth of the total mortality and one-fifth of that due to tropical diseases. At El Tor, Ruffer and Willmore had a case mortality of 91 per cent in chronic amœbic dysenteries among the pilgrims before the introduction of emetine. In Calcutta at the same period, the writer had a mortality of 43·3 per cent in a small series of cases treated with large doses of ipecacuanha by the mouth; but during the next three years, under emetine injections, the mortality was only 12·5 per cent, nearly all in cases admitted with hopeless gangrene of the bowel or complicated with kala-azar. Vedder agrees with Rogers that all but nearly moribund patients can now be cured with emetine. In the Panama Canal zone, where the cases presumably come under early observation, Deeks reported 65 cases with only one death under treatment with large doses of bismuth subnitrate, but subsequently stated that emetine had a more definite specific effect. The stage of the disease greatly affects the death-rate, as patients are not infrequently admitted to hospital with a gangrenous condition of the greatly thickened lower bowel wall and local peritonitis, often without actual perforation, from which recovery is not possible, the patients dying within a very few days of admission. Apart from this grave

condition, and from hepatic complications, the prognosis of the disease, as far as recovery from the particular attack is concerned, is now very favourable under emetine, although a certain proportion of the cases subsequently relapse and require renewed treatment.

During the war amœbic dysentery was especially prevalent in Gallipoli and Egypt during 1915, but to a less extent than at first thought. It was also frequent in Mesopotamia and East Africa, but the mortality was low on account of the prompt use of emetine; so as far as the mortality is concerned the prognosis is now very good.

On the other hand, prolonged and close observation of cases, with frequent microscopical examinations of the stools, has revealed that the prognosis as regards the prospect of complete and permanent recovery is less favourable than was formerly thought to be the case, relapses having been frequent. A total of 10 to 12 gr. of emetine in 1-gr. injections will cure the great majority of cases, and the subsequent use of bismuth emetine iodide orally enables 95 per cent of the total to be permanently cured (Jepps and Maekins). The ultimate prognosis is, therefore, now very good in nineteen out of every twenty cases.

Factors Influencing the Treatment in Individual Cases.—The dangerous conditions are great thickening of the bowel wall, enabling it to be felt as tender sausage-shaped masses through the anterior abdominal wall, and indicating gangrene and local peritonitis; the passage of black cobweb-like sloughs of the mucous membrane; local peritonitis, only occasionally due to actual perforation, sometimes with post-colic abscess usually on the right side of the abdomen, or general peritonitis.

Unfavourable symptoms are cold, clammy skin, hiccough, and a very high degree of leucocytosis such as 40,000 and over (up to 30,000 may not rarely be recovered from). The number of the stools is of comparatively little significance, as actual constipation may result from gangrene of the bowel, when the case may not even be recognized as dysentery during life. Very severe hæmorrhage may also be dangerous, but usually is readily controlled by emetine.

Complications.—In addition to gangrene of the bowel or peritonitis with or without actual perforation, by far the most common and serious complication is acute hepatitis going on to liver abscess. In acute sloughing amœbic dysentery, numerous small abscesses may result, producing a very serious condition. More frequently, a single large abscess forms insidiously—especially in chronic or latent amœbic ulceration of the large bowel—the prognosis of which is separately considered (*see* AMŒBIC LIVER ABSCESS). Amœbic abscess may rarely form in the spleen or brain, both being serious, especially the latter, as amœbic abscess of the spleen may yield to aspiration and emetine injections. Arthritis has also been recently described as following amœbic dysentery and yielding to emetine.

Leonard Rogers.

DYSMENORRHŒA.—

1. **Spasmodic.**—This variety is the commonest, and in many ways the most troublesome. Great difficulty is experienced in giving an opinion as to the evolution of a case of spasmodic dysmenorrhœa.

There are three points upon which the attention should be focused: (a) The severity of the symptoms; (b) The physical development and tone; (c) The neurotic element.

a. *The Severity of the Symptoms.*—This must be gauged not only by subjective impressions, but also by an attempt to fix by other means the standards of expression of pain peculiar to the patient.

In cases where the pain is severe, localized exactly in the hypogastrium, and lasts for a day or two with definite paroxysms, it is usually a waste of time to employ medicines; on the other hand, where the symptoms do not appear intense, and the other features are good, it may be taken that in the majority of cases simple medical remedies, attention to physical hygiene, and sufficient rest, will be successful.

b. *The Physical Development and Tone.*—In the first place, dysmenorrhœa in the small infantile uterus is almost intractable to medical or lesser surgical measures (such as dilatation, which brings at most only temporary relief). In the majority of cases an extirpation is eventually required.

Next, in cases with a conical cervix or with antelexion, the results of medical treatment are small, while dilatation or incision of the cervix is permanently successful in at least 50 per cent of the cases, and in many more for a period of from one to five years. The failures are in many cases explained by faulty operation, in which the internal os

escaped dilatation. Older gynæcologists are agreed that the use of the glass stem enhances the chance of cure in cases of antelexion.

In those cases in which there is no physical defect, attention should be paid to the general tone of the body; many patients in weak health, physically exhausted and anæmic, only require judicious correction of errors, and medical measures, in order to recover completely.

c. The Neurotic Element.—The greatest difficulty will be found in estimating the proportion due to an underlying neurosis, and that due to the effect of continued dysmenorrhœa. The patients are usually thin, and often the subjects of bad circulation.

There is no doubt that the continued pain endured for years leads eventually to a lowered resistance, and a morbid fear of the forthcoming period, while relief is often found in alcohol, or in morphia injections. Under these circumstances it is rare for medical treatment alone to be successful, and cervical operations give as a rule but a temporary benefit.

Reviewing, then, the prognosis of spasmodic dysmenorrhœa in general, it is seen that the greatest circumspection is required in forming an opinion. Beyond the special points detailed above, other factors are the age of the patient and the presence of sterility. Sterility is an indication for dilatation—and the results are perhaps best expressed in the following figures given by Brickner¹: Of 38 patients suffering from dysmenorrhœa and sterility, only 27 per cent were cured of both the sterility and the dysmenorrhœa.

The following figures also give some indication of the outlook in dysmenorrhœa generally. Findley² quotes Kelly as follows: Of 95 cases of dilatation, 18, or 19 per cent, were permanently relieved; 14, or 14·7 per cent, received great benefit; and 7, or 7·4 per cent, were completely relieved for from one to twelve years, when, however, the pain returned.

Brickner¹ used Dudley's operation instead of dilatation in 73 cases—42 for dysmenorrhœa alone, and 38 for dysmenorrhœa with sterility—and obtained the following results: Of the 42 patients with dysmenorrhœa, 64·3 per cent were relieved; 33·3 were not relieved; and 2·4 per cent were worse; of the 38 patients with both dysmenorrhœa and sterility, 27 per cent were cured of both.

2. Membranous.—This much rarer condition is decidedly more grave in outlook; it has not been successfully treated by drugs, and it nearly always recurs after dilatation and curettage. It is important to try to discover the presence of any pelvic disease; thus, in a few cases operation has revealed a tuberculous condition of the appendages, associated with tuberculous endometritis, and hysterectomy has brought permanent relief.

3. Congestive.—This covers a wide field, and is after all but a symptom in the course of pelvic inflammatory disease or uterine displacement, so that it rarely requires consideration from the point of view of the dysmenorrhœa. Nothing, however, is more striking than the alleviation of the symptoms which results from the correct treatment of the underlying pathological lesion.

4. Intermenstrual Pain ('Mittelschmerz').—Regular intermenstrual pain, apart from pathological changes in the pelvic viscera, is a rare occurrence. Where there is gross disease, such as salpingitis, the appropriate surgical treatment brings relief. In those cases where no fault can be found with the pelvic viscera, palliative measures and analgesic drugs must be tried; the prognosis as to relief in this class of case is unfavourable.

REFERENCES.—¹*Surg. Gynecol. and Obst.* 1911, ii, Nov.; ²*Diseases of Women*, 1914, 51.

Eardley Holland.

EAR DISEASE, INTRACRANIAL COMPLICATIONS OF.—(See INTRACRANIAL COMPLICATIONS OF EAR DISEASE.)

ECLAMPSIA.—In round numbers, it may be said that about 20 per cent of women who get eclampsia die; the statistics published by leading authorities show variations in maternal mortality from as high as 30 to as low as 5 per cent. Such differences depend essentially on the type of cases, whether severe or mild, and on methods of treatment. It is notoriously difficult to foretell what course a case of eclampsia will follow when seen in an early stage, and this treacherous element is the chief stumbling-block to accurate prognosis; cases which begin mildly may unexpectedly develop into the most virulent

type. The prognosis, therefore, should always be a guarded one. After the disease has been in progress for a little time, it is not so difficult to pronounce judgement, and the presence or absence of certain symptoms affords a certain amount of help in prognosis. These will be discussed below. As regards treatment, great hopes were held out a few years ago that the rapid emptying of the uterus in ante-partum cases, by abdominal or vaginal Cæsarean section, would revolutionize the mortality figures. Such fond hopes have been dispelled, and the general body of authoritative opinion is now returning to an intensive form of conservative eliminative treatment.

The Cause of Death in Eclampsia.—Death may be due to the intensity of the toxæmia (as evidenced post mortem by profound degenerative changes in the liver and other organs), to exhaustion and heart failure (as a direct consequence of many rapidly recurring fits), to pulmonary œdema and septic pneumonia (due to the continuation of fits and coma and the aspiration of saliva, mucus, or vomit), to cerebral hæmorrhage (not uncommon, and due to the combined effect of high blood-pressure and degenerative changes in the walls of the blood-vessels), or to pulmonary embolism. After the acute attack is over, puerperal sepsis is a not uncommon cause of death (eclamptic patients are very prone to septic infection). The injuries and accidents due to operative delivery (such as *accouchement forcé*, hæmorrhage from deep tears of the cervix, Cæsarean section) account for a certain number of deaths, for a profoundly toxæmic and exhausted patient is not in a good state to stand shock and loss of blood.

The prognosis is chiefly concerned with three points: (I) *The immediate maternal prognosis as to death or recovery.* (II) *The remote maternal prognosis:* (1) Is eclampsia likely to be repeated in future pregnancies? (2) Is there likely to be permanent damage to the kidneys, i.e., what is the chance of chronic renal disease? (III) *The foetal mortality.*

I.—THE MATERNAL PROGNOSIS.

The Maternal Prognosis from the Clinical Aspect of the Case.—

MODE OF ONSET.—Eclampsia beginning before labour has the highest mortality, during labour less, and after labour the least; but the differences are not very great. Cases which are preceded by a more or less long period of symptoms of toxæmic albuminuria, especially where there is pronounced general œdema, are not of such a virulent type as those in which the attack arises unexpectedly and without warning symptoms. The most virulent type appears to be that in which the onset is very sudden, the first convulsion appearing in a patient who, an hour or two previously, seemed in good health.

SPECIAL SIGNS AND SYMPTOMS.—Those having a special prognostic significance are: (1) The convulsions, their number and frequency; (2) The presence or absence of prolonged coma; (3) The pulse; (4) The temperature; (5) The urine; (6) Jaundice; and (7) Pulmonary symptoms.

1. *The Convulsions.*—It may be accepted as generally true that the prognosis becomes progressively worse as the number of convulsions exceeds 20. But the prognosis by no means depends on the mere number, for patients who have had 50, or even 100, have recovered; severe, prolonged, and rapidly repeated convulsions make the prognosis very bad, more especially if accompanied by deep coma in the intervals and a rising pulse-rate. The fits can be controlled by morphia or chloral, but chloroform should not be used.

2. *Coma.*—Deep and prolonged coma, especially if associated with a rapid and weakening pulse and with temperature, is a bad sign.

3. *The Pulse.*—The state of the pulse is regarded by many as the most valuable prognostic sign of all; so long as the pulse is slow and steady the prognosis remains good, but becomes extremely grave if the pulse is rapid, weak, and compressible.

4. *The Blood-pressure.*—In eclampsia the blood-pressure is always high to begin with. A falling pressure is of good omen if other symptoms are declining and the pulse remains steady; but a falling pressure combined with a rising and weakening pulse, and a continuation of severe convulsions and coma, makes the prognosis as grave as possible.

5. *The Urine.*—Suppression of urine is a sign of great danger, and the prognosis becomes progressively hopeful when the secretion of urine begins to increase. The amount of albumin is not of great importance in assessing the severity of a case.

6. *Jaundice*.—Jaundice is rare, but when present is a sign of very grave significance, and is seldom seen in other than fatal cases. Its presence indicates widespread destruction of liver tissue. In the very worst cases small subcutaneous hæmorrhages are seen.

7. *Pulmonary Signs*.—Symptoms of pulmonary œdema, such as rattling in the chest, deep cyanosis, and laboured respiration, are usually precursors of death.

The Maternal Prognosis from the Point of View of Treatment.—There can be no doubt whatever that the prognosis is greatly influenced by treatment; not only by the particular method of treatment adopted, but also, what is of very great importance, by the stage of the disease at which treatment is begun; the earlier the patient comes under treatment the better the results. There are two sharply opposed bodies of opinion on treatment: that which believes in rapid emptying of the uterus, and that which emphatically does not. The radical or surgical school, assuming that the placenta (or fœtus) causes the disease by producing toxins and pouring them into the maternal circulation, argue that the sooner the placenta is got rid of the better, and perform abdominal or vaginal Cæsarean section in all cases. The school of expectant or conservative treatment believe that the important things to treat are the patient and the toxæmia; even though the placenta may be the primary or antecedent cause, they cannot believe that a fully established disease, already accompanied by profound degenerative changes in important organs, can be beneficially influenced by a severe operation on a patient who is already struggling for life, and not in a good state to withstand surgical shock. They aim at eliminating the toxins and controlling the convulsions by starvation, purgation, repeated colon and stomach wash-outs, venesection, saline infusion, and morphia; labour, in ante-partum cases, is induced, and delivery may be completed by forceps, but nothing radical is done to complete labour, such as manual dilatation of the cervix or delivery by version. A few years ago a large body of expert opinion believed that the mortality of eclampsia would be revolutionized by the routine employment of Cæsarean section in ante-partum cases, the earlier the operation being performed the better. The most modern statistics have dashed these hopes to the ground, and there can now be little doubt that the radical treatment compares most unfavourably with the conservative.

In comparing statistics, it should be kept in mind that the general mortality (i.e., for all sorts of cases treated by all sorts of methods) is in the neighbourhood of 20 per cent. The chief protagonist of expectant treatment in this country is Hastings Tweedy¹—in the Rotunda Hospital, between the years 1908 and 1915, 82 cases were treated expectantly, with a maternal mortality of 7·3 per cent; from Russia, the late Professor Stroganoff² has reported a series of 839 cases, extending over many years, treated expectantly, with a maternal mortality of 10 and a fœtal mortality of 22 per cent; from Germany, Lichtenstein's³ latest series of 94 cases, treated expectantly, showed a maternal mortality of 5·4 per cent. It is important to note, as proving the importance of early treatment, that 60 of Lichtenstein's patients came under treatment after the occurrence of five fits, with only one death, a percentage mortality of 1·7.

Turning now to the results of abdominal Cæsarean section, Peterson⁴ collected 283 cases from Europe and America, operated on between 1908 and 1913, and found a mortality of 26 per cent. The latest figures are those obtained by Munro Kerr and Eardley Holland,⁵ who collected 196 cases of Cæsarean section by British operators between 1911 and 1920 inclusive, and found a maternal mortality of 32 per cent and a fœtal mortality of 32 per cent; there can, however, be very little doubt that this high figure was partly accounted for by the fact that, in many cases, the operation was performed in the late stage of severe cases which had failed to respond to expectant treatment. Fromme's⁶ figures are better; he records a series of 58 cases treated by abdominal or vaginal Cæsarean section in which the results are classified according to the number of convulsions that occurred before the operation; of 46 operated on after one to five convulsions, the mortality was only 8·7 per cent. But his operative results compare badly with Lichtenstein's 60 cases in which expectant treatment was begun after one to five fits had occurred, and which resulted in the low mortality of 1·7 per cent. The routine treatment of eclampsia by Cæsarean section, so far as published results go, thus compares very unfavourably with expectant treatment. The position is admirably stated by Blacker⁷: "If Cæsarean section is to become the routine early treatment of eclampsia,

the results obtained must be compared with those of early expectant treatment ; and when we remember that the minimal mortality of Cæsarean section practised upon healthy women is 1.5 to 2 per cent, it is impossible to believe that its performance, even early, in the case of women suffering from so dangerous a condition as eclampsia, is likely to yield results at all comparable with those obtained by the early institution of expectant treatment."

II.—REMOTE MATERNAL PROGNOSIS.

1. *Is eclampsia likely to be repeated in subsequent pregnancies?* The answer to this question is that it is extremely unlikely ; cases of repeated eclampsia are very rarely heard of.

2. *Is the kidney likely to become permanently damaged and the patient to get chronic renal disease?* Although we know that chronic renal disease sometimes follows eclampsia, there exist at present no statistics of follow-up cases to inform us how often this may be expected. Caldwell and Lyle, in an examination of 24 eclamptic patients two and a half years after delivery, found 2 instances of chronic nephritis. A striking capacity for rapid improvement is shown by the kidney in recovered cases of eclampsia. As a rule, the blood-pressure falls to normal in a few days, and the albumin disappears in two or three weeks. If raised blood-pressure persists for more than a fortnight, the case becomes suspicious. Albuminuria may last as long as six weeks before disappearing entirely, but such a case should cause anxiety. It is a safe rule to treat all eclamptic patients for at least six weeks after labour like cases of nephritis, by careful rest and diet.

III.—THE FŒTAL PROGNOSIS.

The fœtal mortality is much higher than the maternal, and is due to a variety of causes : (1) Prematurity ; (2) Toxæmia ; (3) Relative placental insufficiency due to retroplacental hæmorrhages ; (3) The injuries and accidents of operative delivery, such as cerebral hæmorrhage or prolapsed cord ; (4) Asphyxiation from the repeated convulsions of the mother, with prolonged cyanosis. In general terms, the later in pregnancy the onset of eclampsia, and the fewer the convulsions, the better is the prognosis for the fœtus.

As regards treatment, there is, of course, no doubt that if the fœtus is alive and viable, abdominal Cæsarean section offers a very much better chance of obtaining a living child than any other method. Thus, in Peterson's statistics of Cæsarean section, when only viable fœtuses were taken into account, the fœtal mortality was as low as 9 per cent. Lichtenstein, grouping all methods of treatment, found a fœtal mortality of 37 per cent, or counting only viable fœtuses, of 21 per cent. Stroganoff, in a series of 839 cases treated expectantly, found a fœtal mortality of 22 per cent.

REFERENCES.—¹Hastings Tweedy, *Reports of Rotunda Hospital, Dublin*, 1908–13 ; ²Stroganoff, *Centralb. f. Gynäkol.* 1912, xxxvi, 1497 ; ³Lichtenstein, *Monats. f. Geburtsh. u. Gynäkol.* 1913, xxxviii, 152 ; ⁴Peterson, R., *Amer. Jour. Obst.* 1911, July, and 1914, July ; ⁵Munro Kerr and Eardley Holland, *Jour. Obst. and Gynæcol. Brit. Emp.* 1921, xxviii, 358 ; ⁶Fromme, *Monats. f. Geburtsh. u. Gynäkol.* xxxviii, 1913, 152 ; ⁷Blacker, G. F., *Jour. Obst. and Gynæcol. Brit. Emp.* 1921, xxviii, 447.

Eardley Holland.

ECTOPIC PREGNANCY.—Since ovarian pregnancy is so extremely uncommon, and primary abdominal pregnancy almost unknown, in this article ectopic will be taken as synonymous with tubal pregnancy. Ectopic pregnancy in the early weeks or months has, beyond the mere fact of the abnormal site of pregnancy, so little resemblance to that in the later months (i.e., from the sixth month onwards) that clinically they amount almost to different states. They will therefore be considered separately.

Early Ectopic Pregnancy.—The diagnosis is nearly always made during the first eight weeks of pregnancy. The prognosis depends chiefly on two points : (a) The condition of the patient when she first comes under observation, which is dependent of course on the changes which have taken place in the pregnant tube ; (b) The method of treatment adopted. These may be considered together.

Wide differences are noted according to whether the patient is seen : (1) Before primary rupture or abortion has occurred ; (2) At the time of primary rupture or abortion ; (3) When a hæmatocele has formed. The prognostic points at issue are : What is the

best and safest treatment for these respective states, and what are likely to be the results, both immediate and future?

1. *Before Primary Rupture or Abortion.*—Opportunities rarely occur of diagnosing ectopic pregnancy at this stage, as there are few if any symptoms beyond a short period of amenorrhœa. The patient is on the brink of a precipice, and is liable at any moment to sudden and perhaps fatal hæmorrhage. The pregnant tube must therefore be removed at once by laparotomy. The prognosis is obviously extremely good, as the operation is a short and simple one, and the mortality indeed should be little more than that entailed by the anæsthetic and the incision.

2. *At the Time of Primary Rupture or Abortion.*—Here the patient may be in a state of extreme shock and collapse from diffuse intraperitoneal hæmorrhage, or, on the other hand, may be suffering from no more than the effects of severe pain and slight intraperitoneal bleeding. In either case a prompt abdominal operation is demanded, following the usual surgical rule of exposing the bleeding point and securing it, which in this case is met by removal of the affected tube. In cases where hæmorrhage has been very profuse and the collapse is extreme, opinion is divided as to whether immediate operation should be undertaken, or whether it is wiser to wait until the patient has begun to rally. We strongly incline to the view that immediate operation as soon as the condition is diagnosed gives the better results; efficient treatment of the shock and collapse may again start the bleeding, while the operation is so quickly performed in most cases that the additional shock may be disregarded. The apparently most hopeless cases recover when the bleeding has been arrested and intravenous saline transfusion (or, better still, blood transfusion, if available) has been carried out simultaneously with the operation. As regards the mortality of the operation in this stage of ectopic pregnancy, the following are some fairly modern figures. In 1891 Schauta¹ collected a large series of acute cases, and showed that among 123 cases operated on there was a mortality of 5·7 per cent; Jacobs,² in 1920, gave statistics of 615 cases operated upon in the first few hours following rupture, with a mortality of 4·4 per cent; Ladinski³ in 1912 recorded 200 operations (including some deferred operations), with 3 deaths. These figures show how excellent a prognosis may be given for the surgical treatment of ectopic pregnancy in the acute stage. The question will sometimes be asked: Will the patient recover without operation? The answer is that she may, but that the risks she runs of dying are very great; in fact, the expectant treatment of ectopic gestation in the acute stage is absolutely unjustifiable. The special risk is that of continued or repeated hæmorrhage. Schroeder found that the mortality amongst 121 cases treated expectantly was 87 per cent.

3. *When a Hæmatocele has been Formed.*—In these cases the patient has recovered from the acute symptoms and has come under later observation with an encysted collection of blood in Douglas's pouch or around the affected tube (a retro-uterine or a peritubal hæmatocele). A study of statistics reveals that operative and expectant treatment show equally good immediate results. But the remote results of operative treatment are far superior, for the slow absorption of these collections of blood is accompanied by the formation of extensive and dense adhesions, which produce anatomical and functional effects on the pelvic viscera (e.g., pelvic pain, dysmenorrhœa, sterility). The dangers a patient is exposed to from not being operated on are repeated hæmorrhage and suppuration of the hæmatocele. A very great disadvantage of expectant treatment is the length of time a patient has to lie up to allow a large collection of blood to become absorbed; it is always many weeks, and sometimes even months. The relative merits of expectant and operative treatment, as regards immediate results, are revealed by the following figures. Blacker⁴ states that at University College Hospital, in the years 1902–12, 78 cases of hæmatocele were under observation; of these, 64 were treated expectantly, with no deaths, and 14 by operation, with no deaths. Champneys, Zweifel, and Thorn have recorded 234 cases treated expectantly, with 1 death (quoted by Blacker, loc. cit.). With such figures may be compared those, given above, of Ladinski, of 200 cases (some in the acute stage and some in the stage of hæmatocele) operated on, with 3 deaths. It must be remembered that a certain proportion of patients under expectant treatment will have to be operated on for signs of recurrent hæmorrhage or for suppuration. Considering that the immediate results of operative are as good as those of expectant treatment, and considering also the liability to recurrent hæmorrhage or suppuration of the hæmatocele,

as well as the length of time required for the absorption of the blood and the inevitable formation of adhesions, the patient and her friends may be safely recommended to choose operation as being the safest and best treatment.

Ectopic Pregnancy in the Later Months.—The surgical difficulties increase with the advancement of the gestation. Thus, the operation is relatively simple when undertaken in the first three months. From thence onwards it becomes a more formidable procedure, because the increased size of the placenta and of the blood-vessels passing into it, of necessity gives rise to profuse hæmorrhage during its removal. So much is this the case in the later months of gestation that all authorities are agreed that in a pregnancy advanced beyond the sixth month it is wiser to postpone any interference until after 'term' whenever possible; at this epoch, with the advent of spurious labour and the death of the fœtus, the subsidence of the placental circulation renders the removal of the fœtus and the separation of the placenta a comparatively innocuous proceeding, attended by inconsiderable loss of blood. Ligation of the internal iliac artery, or compression of the aorta, may be of great assistance in the technique of these operations.

It may, however, happen that the surgeon is forced to intervene during the later months of pregnancy, either by reason of rupture of the sac or separation of the placenta causing internal hæmorrhage. The risk under these circumstances is always considerable, and may be further aggravated by the site of the placental implantation. Thus, in intraligamentous pregnancy, practically the whole of the chorion is placentous, and its removal is accompanied by very great bleeding; if, on the other hand, the surgeon contents himself with removing the fœtus only, and trusts to the placenta to separate by necrotic disintegration, the possibility of septic infection further complicating the process is considerable. When, however, the gestation sac is intraperitoneal, the removal of the placenta is often more easily accomplished, and especially so when it is chiefly vascularized by omental vessels through the medium of adhesions.

Finally, it is to be remembered that it is generally impossible to find peritoneum with which to cover the site of implantation, and that the adherence of intestine or the formation of peritoneal bands is not uncommon; in the former case an intestinal obstruction may occur, and has been recorded as the cause of death in several cases.

The Effects of Ectopic Pregnancy on the Future Reproductive History.—Many cases of tubal pregnancy are of purely accidental origin, but many are the expression of relative sterility of tubal origin. A preceding salpingitis, though it may leave the tubal mucosa healthy enough for implantation of the ovum, leaves peritoneal adhesions and kinks whereby the passage of the ovum down the tube is impeded. Hence, as would be expected, since both tubes are usually affected by salpingitis, a certain number of women who have had an ectopic pregnancy remain sterile, and a smaller number suffer from a repeated tubal pregnancy. The approximate figures are: about 33 per cent have normal uterine pregnancies later, and about 5 per cent have a repeated tubal pregnancy.

REFERENCES.—The writer has freely consulted the article on "Ectopic Pregnancy" by Dr. G. F. Blacker, in the *New System of Gynæcology* (Eden and Lockyer), 1917, i, 417. ¹Schauta, *Beiträge z. Gyn. u. Therap. der Extrauterinenschwang.* Prag, 1891; ²Jacobs, *Bull. de la Soc. Belge de Gyn. et d'Obst.* 1909-10, xx, 39; ³Ladinski, *Jour. Amer. Med. Assoc.* 1912, lix, 854; ⁴Blacker, *New System of Gynæcology*, 1917, i, 417.

Eardley Holland.

ECZEMA AND ECZEMATOUS ERUPTIONS.—It is impossible to lay down brief rules for prognosis in eczema, for under that name several conditions of widely diverse origin are included. The points which influence the prognosis in the principal varieties are as follows:—

1. **Eczema due to External Irritants.**—Many conditions known as eczema are the result of the irritation of substances used in professions and trades. The possible irritants are so numerous that it would be out of place to enumerate them here. Certain soaps, soda, prolonged immersion in water, sugar, chemicals used as antiseptics, in photography, and in manufactures (e.g., aniline dyes, bichromates, bleaching agents, trinitrotoluene and other high explosives), or medicinally applied, may all cause this type of eruption. Exposure to strong sunlight is sufficient to cause a dermatitis in some subjects. Certain plants act similarly. As a rule, on the removal of the patient from the source of irritation, this form of dermatitis yields rapidly to simple soothing applications. Recurrence is

almost certain if the exposure to the irritant is repeated, and in many instances the skin becomes more and more easily affected as the attacks recur. In other instances a species of immunity may be acquired.

2. **Parasitic 'Eczema.'**—Under the name 'eczema' are included certain forms of eruption produced by ringworm fungi. These occur especially in the groin, axilla, and on the extremities. They yield to antiparasitic remedies, and are discussed with the ringworms. The most rebellious cases are those in which the eruption occurs between the toes and on the adjacent part of the sole. It is to be remembered that relapses are often due to neglect of disinfection of clothing.

3. **'Seborrhœic Eczema.'**—This variety is associated with dandruff of the scalp and a greasy condition of the skin, and chiefly affects the middle line of the trunk, the face, and the flexures. It usually clears up rapidly under treatment by sulphur, resorcin, and salicylic acid, provided the condition of the scalp can be controlled.

4. **Eczema of Infants.**—This commonly involves the face. It usually begins in nurslings, and is often very intractable. An essential feature in successful treatment is the avoidance of scratching, which causes secondary pus-coccal infection. In most cases the dietary requires attention. The course is tedious, but the prognosis is good on the whole; relapses, however, are common, especially during the period of dentition. In a small proportion of cases seen in hospital practice the affection is persistent, or may for years merely show temporary remissions.

5. **Eczema dependent on Antecedent Conditions of the Skin.**—The xerodermatous and ichthyotic skin is very prone to eczema, which tends to recur every cold season. The eczema can usually be prevented by treating the congenital condition by regular bathing, and by the inunction of glycerin and water, or some oily preparation, daily; this should be made part of the daily toilette.

Varicose veins are a common cause of eczema, and the prognosis depends upon the possibility of the patient keeping the parts at rest. If this can be enforced the eczema soon yields to treatment. If the limb can be properly supported by appropriate bandages, many patients, especially women of the working classes, can be saved from outbreaks of eczema, but relapses are exceedingly common.

The senile skin is also prone to eczema, and very troublesome cases are met with in elderly subjects. The prognosis in these cases is usually unsatisfactory.

6. **Eczema of Doubtful Origin.**—In many cases we are at a loss to determine the cause of eczema. We may get evidence of gout, rheumatism, diabetes, renal disease; or there may be some antecedent general illness; or, again, we may be entirely unable to account for the condition. Here we have also to treat any general affection present, and the prognosis will depend in the main upon our success in determining and dealing with the underlying cause. Local applications may frequently clear up an attack, and by dietetic measures, hydrotherapy, etc., we may relieve the affection of the skin; but relapses are common unless the primary condition can be removed. *J. H. Sequeira.*

EMPHYEMA.—We have a fair amount of reliable material, gathered from a wide area, from which to judge of the prognosis of emphyema, and the results of treatment show a remarkable constancy.

Prognosis apart from Operation.—Apart from treatment by evacuation of the pus, death usually results from cachexia, after a long illness. A sudden fatality is not uncommon. Spontaneous relief, though unusual, is not impossible. The patient usually goes on for many weeks with fever, wasting, and signs in the chest; at length the pus bursts, either through the chest-wall—commonly just outside the apex-beat of the heart,—or it may be coughed up. This involves some risk of sudden death; but if the immediate danger is survived, patients sometimes get well. Pneumothorax may result. Bursting through the chest-wall seldom results in cure; a very persistent sinus generally remains. In both methods of natural cure, the lung is likely to have been long pressed upon, and so fail to expand properly, causing cirrhosis with cavities and chronic invalidism.

Prognosis after Drainage.—In older children and adults, the mortality after drainage operations seems, in hospital patients, to be very constant at about 1 in 5, as the table on the next page shows.

In the great majority of cases the operation involves removal of a piece of rib. Of

EMPHYEMA

late years, a good deal of dissatisfaction has been expressed with the rib-resection method of treatment. Apart from the immediate risks of operation, there is the danger that the lung may fail to expand, and a permanent cavity remain discharging pus. Secondary operations, either to drain a subsidiary pocket of pus, or to close a persistent sinus, are too frequently called for. No doubt a too-late diagnosis of the empyema is responsible for much of this trouble, but experience in France taught us to dread an open pneumo-

MORTALITY AFTER DRAINAGE OPERATIONS.

Reporter					Cases	Died
						per cent
Lloyd	-	-	-	-	200	20.0
Lord	-	-	-	-	252	22.0
Schede	-	-	-	-	389	12.3
Lenharz	-	-	-	-	120	25.8
Armitstadt Children's Hospital	-	-	-	-	178	21.9
St. Bartholomew's Hospital	-	-	-	-	499	22.2
Mozingo (closed method)	-	-	-	-	138	2.0

thorax, and efforts are being made to establish drainage and sterilization of the cavity without having recourse to the big rubber empyema tube. Mozingo has obtained extraordinarily good results by stabbing with a trocar and cannula in the 9th intercostal space, and introducing a rubber tube through the cannula, which is then withdrawn, leaving the tube *in situ*. Through it the pus is aspirated by a syringe every three hours, and no air allowed to enter. About 20 to 60 c.c. of Dakin's fluid is introduced, and sucked out again till it returns clear; some is left in for five to thirty minutes and then withdrawn. At

ASPIRATION v. EARLY DRAINAGE FOR EMPYEMA IN EPIDEMICS.

	EARLY DRAINAGE			ASPIRATIONS; late drainage if necessary		
	Cases	Deaths	Mortality per cent	Cases	Deaths	Mortality per cent
Rodman - - - -	50	23	45	133	13	10
Stone - - - -	85	49	61.2	190	24	12.6

least once a day the cavity is to be filled to three-quarters of its capacity, to avoid pockets of pus. After a week 10 c.c. of 2 per cent formalin in glycerin is injected once or twice a day. The cavity soon becomes sterile under this line of treatment. The patient is got up as soon as possible, to expand the lung. Of 138 patients treated along these lines, the majority acute early cases but including 45 chronic empyemata, only 2 per cent died. It is only fair to say that the drainage operation, also, has a very low mortality in early acute post-pneumonic cases.

The mortality is influenced, not only by the method of treatment, but also by (1) *The age of the patient*; (2) *The bacteriology of the infection*; and (3) *Whether the empyema is unilateral or bilateral*.

1. *Age*.—In infants, under two, there are many deaths. Natan reports 145 cases, mostly treated by a drainage operation, with a death-rate of 64 per cent. Zybell considers that simple puncture, repeated when necessary, gives better results. His figures are: of 13 babies treated by puncture, 7 died; of 7 babies treated by drainage operation, 6 died.

2. *Bacteriology*.—The principal types are the pneumococcic, which affords the best prognosis; the tuberculous or sterile (which usually means tubercle), which is not likely to do well because of the probability of pulmonary disease; and the mixed infection with hæmolytic streptococci and other organisms, that follows big epidemics of influenza or measles. Army camps in America in the winters of 1917 and 1918 furnished much material of this last variety, and there were many deaths. Numerous observers found that early drainage operations for these cases was followed by very bad results, apparently because the collapse of the lung thereby induced suddenly threw too much work on the

other lung, which might itself be bronchopneumonic. It takes a week or two before the mediastinum becomes so fixed by inflammatory adhesions as to resist displacement. Much better results were obtained, as shown in the above table, by early repeated aspiration, and late drainage if rendered necessary by the appearance of thick pus. All the camps came to the same conclusion.

PROGNOSIS ACCORDING TO BACTERIOLOGY. .

Infection	Reporter	Cases	Cured	No better	Died
Tubercle - - -	Küster	31	9	6	16
	Schede	45	10	—	35
	Lord	9	1*	—	8
Pneumococcus - -	Lord	35	—	—	4
Epidemic Streptococcal	Stone	52	—	—	33

* Recovered with a sinus.

3. *Double Empyema* is a grave condition, but in pneumococcal cases probably about half recover.

The two most favourable varieties of empyema are, the kind that arises without obvious cause in non-tuberculous subjects, and the post-pneumonic form. According to Lord, of 288 post-pneumonic cases, 13 per cent died, the period of illness averaging eighty-three days; of 101 idiopathic cases, 8 per cent died, the illness lasting, on an average, sixty-six days.

Grave types are those associated with pandemic influenza or measles, pyæmia, subphrenic abscess, phthisis, or abscess of the lung.

The operation itself is not altogether devoid of danger. Chloroform deaths are not very infrequent; and there are about a dozen cases on record in which convulsions followed close upon the evacuation of the pus.

Eventual Results.—Much depends upon early diagnosis and operation. If the lung has been compressed for weeks, it will probably fail to expand, and a persistent sinus will result, especially in tuberculous patients.

A sinus, however, is by no means a death warrant. Godlee writes of two of his operation cases who, wearing a tube, lived in moderately good health for many years, up to seventeen in one instance. Estlander's operation has a considerable mortality, perhaps about 10 per cent; but this varies much with the number of ribs that have to be resected and the condition of the patient's general health. A late decortication is quite as dangerous as an Estlander. Careful preliminary sterilization of the cavity by Carrel's method much reduces the risks.

Lord followed 13 cases of primary (idiopathic) empyema for a number of years; 9 were well four years after, 2 died of lung troubles, and 2 of intercurrent disease. Of 26 post-pneumonic cases investigated five years later, 15 were well, 1 had phthisis, 2 had had hæmoptysis, in 1 there was a persistent sinus, and 7 were dead (4 of lung affections and 3 of intercurrent diseases).

REFERENCES.—Lord, 'Empyema', *Osler and McCrae's System of Medicine*; Werner, *Deut. Zeits. f. Chir.* 1913, Sept., 419; Gee and Horder, *Allbutt's System of Medicine*, 1909 ed., v, 56; Zybelle, *Monats. f. Kinderh.* 1912, xi; Mozingo, *Jour. Indiana St. Med. Assoc.* 1920, xiii, 46; Stone, *Amer. Jour. Med. Sci.* 1919, clviii, 1; Gage, *Boston Med. and Surg. Jour.* 1919, clxxxi, 84; Rodman, *Penn. Med. Jour.* 1919, xxiii, 65.

A. Rendle Short.

ENCEPHALITIS LETHARGICA.—This disease, which was first accurately described in 1917 by Economo in Vienna, may occur sporadically or in epidemic form. Its toxin may attack any part of the grey matter of the brain, but most commonly it has a selective action upon the nuclei of the mid-brain and floor of the Sylvian aqueduct, and especially upon the oculomotor nuclei, producing ocular palsies, more or less complete. But the morbid process may also attack other nerve-centres. Thus, for example, the nuclei of the lower cranial nerves in the medulla may be attacked; in other cases the pallidal cells of the corpus striatum are specially picked out, producing the clinical picture of acute paralysis agitans, with its characteristic facies, posture, rigidity, and tremor; or symptoms of chorea or of athetosis may result; in others again the cerebral cortex is attacked,

producing monoplegic, hemiplegic, aphasic, or even mental symptoms ; or the cerebellar cortex may suffer, producing symptoms of inco-ordination, etc. In still another variety acute rhythmic myoclonic contractions occur, especially affecting the muscles of the abdomen and limbs.

In all varieties of this polymorphic malady extreme drowsiness is a characteristic feature, usually occurring early in the disease, with the singular exception of the acute myoclonic type, in which the lethargy supervenes when the myoclonus passes off.

A certain proportion of cases are fatal within one to three weeks. The rate of mortality is very variable. In 102 cases collected by myself, 27 terminated fatally. Of these, Hall recorded 16 cases without a death, whereas, out of 15 cases of my own, 3 were fatal, and Siemerling had 7 deaths out of 20 cases.

The acute myoclonic variety of encephalitis lethargica is specially grave and nearly always fatal. It is characterized by a febrile onset, with severe shooting pains in the trunk and limbs, followed within a few days by rhythmic, shock-like, clonic contractions, 30 to 40 per minute, closely resembling those produced by electrical stimulation of muscles. Instead of the initial drowsiness of ordinary encephalitis, there is insomnia, gradually culminating in delirium. Later, the myoclonic jerkings subside and the patient passes into lethargy, with ocular palsies, etc., as in the common type of encephalitis lethargica. Coma may supervene before the fatal issue, which usually occurs within two or three weeks.

In the ordinary lethargic type, during the early pyrexial stage, whilst the infection is an advancing one and the organism and its toxin are invading the various nerve-centres, death may result from direct action upon the vital medullary centres. In patients with severe medullary infection, an intercurrent pneumonia may prove fatal. During the febrile stage of the malady, therefore, no prognosis should be ventured on.

If the patient survives the first few days of the disease, the fever subsides, and the prognosis is now dependent upon how many of the affected nerve-cells have undergone irreparable degeneration, and how many have been merely temporarily poisoned but not destroyed ; so that, as the inflammatory exudation subsides, functional recovery takes place in such nerve-cells as have not been vitally damaged.

Some cases apparently recover completely. The majority, however, leave behind some persistent sign of nuclear disease, generally incomplete. The commonest result is a partial nuclear ophthalmoplegia, internal or external. Facial paresis of nuclear type is perhaps the next commonest, but other motor cranial-nerve nuclei may also be affected, either alone or in conjunction with the oculomotor or facial nuclei.

In another group of cases implication of the corpus striatum may produce permanent signs of paralysis agitans, chronic chorea, or athetosis, with corresponding disturbances of attitude and gait. In such cases of encephalitic paralysis agitans the symptoms usually reach their maximum within a few days or weeks, and do not subsequently tend to become progressively more severe as in the ordinary degenerative type of the disease ; whilst encephalitic chorea tends to remain chronic and does not show the tendency to clear up completely as in ordinary chorea. There is also a relapsing variety of the disease in which, after temporary improvement and apparent recovery from the primary lethargy, the symptoms reappear after a few days and may prove fatal. In a case of this sort which I myself observed, the patient, after recovering almost completely from the primary attack, had a relapse a fortnight later and ultimately died, two months after the original onset of the disease.

Amongst the rarer sequelæ are root-pains in the upper limbs, the causation of which is quite obscure, but they may be extremely persistent. I remember one patient in whom these pains, affecting the left side of the neck and upper arm, were still present, in conjunction with mild ophthalmoplegia, twelve months after the original attack. Another rare sequela is that of acute insanity, of which I have seen one example where the patient, on recovering from the initial lethargy and ophthalmoplegia, became acutely confused, with violent excitement. This lasted a few weeks and then cleared up completely. Curiously enough, in this case the patient, who had been a chronic epileptic since her youth, went for many months afterwards without an epileptic fit, and even then the epileptic recurrences were milder in degree and at longer intervals, despite the absence of bromide medication, which had been completely withdrawn at the time of her attack of encephalitis.

J. Purves Stewart.

ENDOCARDITIS, RHEUMATIC.—(See RHEUMATIC PERI-, MYO-, and ENDOCARDITIS ; HEART, CHRONIC VALVULAR DISEASE OF.)

ENDOCARDITIS, ULCERATIVE (See also RHEUMATIC PERI-, MYO-, AND ENDOCARDITIS).—It may seem almost a waste of time to discuss the prognosis of so hopeless a disease ; but recent work has shown that the outlook is not quite uniformly desperate.

The expectation of life, dating from the onset of symptoms, varies from a few days to two or even three years in the cases that end fatally, while complete recovery appears to occur in a small percentage. It is difficult to say exactly what that percentage is—probably less than five per cent achieve a real cure. It may even be objected that this is an unduly optimistic figure, but allowance is made in it for the fact that a more general practice of making cultures from the patient's blood is leading to the recognition of a number of comparatively benign cases—cases which might easily be mis-labelled chronic valvular disease, were it not for the application of laboratory methods. Death may be due to a variety of causes, the most important being cardiac failure, embolism of brain, lung, or heart, uræmia, and general toxæmia.

The cases in which recovery may ensue belong almost exclusively to one category (subacute bacterial endocarditis of Libman, chronic ulcerative endocarditis of Osler, endocarditis lenta of Schottmüller). The discrimination between this and other types rests on clinical and bacteriological grounds. The symptoms that characterize this group of cases are such as suggest that the blood infection and its results are of a comparatively low virulence. Fever is moderate, and there are afebrile intervals ; the patient wastes and loses colour, but often so gradually that he scarcely realizes it ; there are usually well-marked signs of valvular disease ; small petechiæ are found, especially on the shoulders and neck, also retinal hæmorrhages in a few cases ; painful, tender, erythematous plaques are common, especially on the fingers, which are sometimes clubbed in shape ; and the urine often contains blood and other evidences of active nephritis. If blood-cultures are positive, the streptococcus which is described in Germany as *S. viridans*, and classified by the St. Bartholomew's Hospital workers with the common streptococci of the alimentary tract, is recovered. Sometimes the influenza bacillus is recovered from cases of a similar clinical type. Usually, however, the blood-cultures prove sterile. The picture is that of chronic valvular disease, with evidences of a comparatively mild bacteriæmia.

At the other end of the scale are ranged those cases in which there is high fever with a wide daily swing, and often with rigors ; the evidences of cerebral poisoning—delirium and coma—dominate the clinical picture, and the signs of heart disease are unobtrusive—so much so that they may be overlooked altogether. From cases of this kind various organisms are recovered : *Staphylococcus aureus*, *Streptococcus pyogenes*, *pneumococcus*, and *gonococcus*. The course is rapid, and invariably fatal. Between the two extremes, every grade of intensity may be encountered.

If generalizations are permissible, it may be said that the discovery of the *Staphylococcus aureus* or of the *Streptococcus pyogenes* is a sure forewarning of a fatal issue after a short illness ; that infection with the *pneumococcus* or *gonococcus* is practically always fatal within a period of three months ; but that in those cases that are associated with *Streptococcus viridans*, *B. influenzae*, or *Staphylococcus albus*, the possibility of recovery may be entertained.

From the clinical standpoint, a serviceable general rule is that the more the case is like chronic valvular disease, the less hopeless is the outlook ; but that where the case is one of septicæmia, with little or no sign of cardiac disease, there is no hope of recovery. An equally unfavourable prognosis is to be given in those cases, seldom diagnosed during life it is true, where the cardiac infection is predisposed to by, and terminates, some chronic cachectic malady such as consumption, cancer, Bright's disease, or diabetes. The hopelessness of such conditions as these is too obvious to call for further comment. On the other hand, at least one case of recovery is on record in which the infective process had apparently attacked a congenitally malformed heart.

Even in the comparatively benign cases, the course is usually run in six months ; and the chance of complete recovery is still so lamentably slender that it is not fair to hold it out as anything but a forlorn hope.

Sudden death sometimes brings this disease to a close. Of Horder's 150 cases, 19 ended in this way. Embolism or hæmorrhage into the brain, or embolism of the cardiac wall, may be responsible. Tearing of a diseased cusp, indicated by sudden change in the murmurs, with aggravation of the signs of cardiac embarrassment, may accelerate death greatly.

Influence of Treatment on Prognosis.—Of this there is unfortunately little to be said. A very few cases are on record in which the application of specific remedies (autogenous vaccines and sera) has appeared to save life, so that it is perhaps fair to claim that cases in which treatment can be carried out along these lines stand a less negligible chance of cure than those in which it is not feasible. Even here, however, not much can be claimed; and it is to be feared that all other methods, such as the intravenous injection of eusol and other antiseptics, must be written off as failures.

Carey F. Coombs.

ENTERIC FEVER.—(See PARATYPHOID FEVER; TYPHOID FEVER.)

ENTERITIS, TUBERCULOUS.—Owing to the formation of adhesions, general septic peritonitis is less likely to occur in tuberculous than in other forms of ulceration of the small intestine, though this disaster is by no means unknown. Moreover, a general peritonitis may occur by organisms, e.g., *B. coli*, escaping into the general peritoneal cavity through a very much thinned intestinal wall, without actual perforation. More commonly, fistulous communications are established into other parts of the intestine, or into localized abscesses. Strictures may arise from fibrotic healing of the ulcers, but it is rare for these to give rise to subsequent intestinal obstruction. Fatal hæmorrhage may occur. The ultimate prognosis depends, in the vast majority of cases, on the presence of tuberculosis elsewhere in the body. This is generally in the lungs, peritoneum, or mesenteric glands. (See also PERITONITIS, TUBERCULOUS).

J. R. Charles.

EPIDIDYMITIS, TUBERCULOUS.—It is difficult and unsatisfactory, in one respect, to discuss the prognosis of an affection which is probably, in the great majority of the cases, only the most evident manifestation of an extensive involvement of the genito-urinary organs. It is obvious that the eventual outlook must usually depend more upon the state of the bladder, prostate, and kidneys, than upon the treatment of the testis. Tuberculosis of the urinary organs is discussed elsewhere. (See KIDNEY, TUBERCULOUS; and BLADDER, TUBERCULOUS.)

We shall here include tuberculous orchitis with epididymitis.

It has been much debated whether the epididymitis is the primary manifestation of tuberculosis in the genito-urinary organs; but favour of late has rather been accorded to the opinion that, in most patients, the kidney, though it may show no signs itself, passes out living tubercle bacilli which invade the prostate, leading to a secondary infection of the vas, and then of the epididymis and testis. It is true that the finger, examining from the rectum, is frequently unable to feel anything in the prostate, but at autopsy this gland is always diseased; it has lately been declared, contrary to the general teaching, that infection of the epididymis begins in the globus minor (that is, nearer the prostate), not in the globus major. All this, of course, has an important bearing on prognosis.

We have very little evidence as to the fate of a tuberculous testis left to itself. No doubt the majority of such cases perforate the skin and lead to chronic suppuration; extension of the disease will also probably take place. A few non-operated cases go on without much change, or even with some improvement, under treatment with tuberculin; but there is little prospect of a cure, and some risk of generalization.

Results of Operative Removal.—We have to discuss the end-results of three methods of treatment by operation: removal of the epididymis, unilateral castration, and bilateral castration.

The immediate mortality after operation is very small indeed. Some patients, however, fall victims to acute general tuberculosis within a few months. The proportion is given as 5.5 per cent by Barney. Much depends on the surgeon's judgement in accepting or rejecting the worst type of cases.

For determining the end-results, we have several valuable publications to guide us; but the subject is complicated, and some of the statistics are scanty in detail or compiled

too soon after operation. Thus, Barney published in 1912 some American hospital figures ; but two-thirds of his 71 cases were followed less than a year, so that his rate of cure, 62 per cent, is high, and the after-fatalities, 5.5 per cent, are much too few. In many points, however, his results are interesting and valuable, as we shall see.

END-RESULTS OF REMOVAL OF TUBERCULOUS TESTIS OR EPIDIDYMISS.

Reporter	Cases followed	Cured	TUBERCULOSIS ELSEWHERE				Died of tuberculosis
			Lungs	Bladder	Other testis	Various	
		per cent	per cent	per cent	per cent	per cent	per cent
Barney* - - -	71	62	—	—	—	32	5.5
Von Bruns - - -	—	46	—	—	26	—	—
Simon - - - -	92	57.6	—	—	—	6.6	35.5
Horwitz - - - -	30	60	3	—	7	7	23.3
Bristol Royal Infirmary -	16	62	6	12	12	—	12

* 64 per cent of these cases followed less than a year.

Von Bruns and Simon publish statistics of patients traced from three years upwards. The first finds 46 per cent cured by unilateral castration, and 56 per cent by bilateral castration. Simon finds 57.6 per cent cured and 35.8 per cent dying out of 92 cases. Horwitz reports a small series, mostly followed for more than a year : 60 per cent were cured and 23.3 per cent died. At the Bristol Royal Infirmary, of 16 cases all followed over eighteen months, 10 were cured, 1 developed phthisis, 2 suffered from cystitis (present before operation), 2 developed tuberculosis of the other side, and 2 (including one of these last) died of pulmonary tuberculosis.

We may conclude, therefore, that when followed for several years afterwards, perhaps rather more than half the cases are cured, and about 20 per cent die of tuberculosis elsewhere. The remainder continue to suffer from various tuberculous affections, such as cystitis, prostatic abscess, phthisis, etc., which were no doubt already present at the time of operation. In Barney's series, nearly half the patients had some evidence of tuberculosis elsewhere than in the testis when first seen ; in 63 per cent the prostate or vesiculæ were affected.

There is some evidence that these coincident manifestations of tubercle may improve after removal of the testis or epididymis. Thus, of the 63 per cent of cases with palpable nodules in the prostate or vesiculæ before operation, Barney found that 18 per cent disappeared, leaving 45 per cent *in statu quo*.

Recurrence in the other testis was observed in 2 out of 16 Bristol cases, in 29 per cent of von Bruns' series, and in 7 per cent of Horwitz's. It may be quite late ; in one of the Bristol cases it occurred six years after the first operation.

Sexual power, according to Barney, was retained in 60 per cent of the unilateral cases ; but azoospermia was present in 11 out of 13. There are, however, plenty of instances recorded, 1 in the Bristol series, in which healthy children are born afterwards. The wife and child do not appear to be infected. Even bilateral castration has no demoralizing effect ; if performed before puberty, it arrests the development of the secondary sexual characters.

The fatal cases die of general tuberculosis, phthisis, or uræmia from tuberculous kidneys.

Results as regards Treatment.—With reference to the effects of treatment, we have to consider unilateral castration, bilateral castration, epididymectomy, and tuberculin.

On paper, the results of *epididymectomy* are better than those of *unilateral castration*. Horwitz gives 1 out of 11 dying after the former, and 6 out of 19 after the latter. Barney also claims greater success. This merely means, of course, that less extensive cases give better results than those in which the testis is already infected, but it affords justification for the practice of leaving the testis if it appears to be uninvolved.

Double castration may be necessary, but it by no means makes a hopeless prognosis ; indeed, both von Bruns and Simon claim better results in these cases than in those in which only a unilateral castration was performed.

Tuberculin appears to be of very decided value in the treatment of this and other tuberculous affections of the genito-urinary tract ; but its claims rest rather on individual reports than upon statistics.

To recapitulate : Rather more than half the patients get quite well ; about 20 per cent die of tuberculosis elsewhere. Bilateral cases are no worse than unilateral in the eventual results. For early cases, epididymectomy is as satisfactory as castration. The operation often leads to improvement of the prostatic nodules, if present. The prognosis in individual cases depends far more upon the tuberculosis of the bladder and other organs than upon the condition of the external genitals.

REFERENCES.—Barney, *Boston Med. and Surg. Jour.* 1912, clxvi, 409 ; Horwitz, *Amer. Jour. Med. Sci.* 1902, xxxviii, 1607 ; von Bruns, *Centralb. f. Chir.* 1901, Report of Congress, 119 ; Simon, *ibid.* 125.

A. Rendle Short.

EPILEPSY.—(See also MENTAL DISEASES.)

The Prospects of Spontaneous Cure, i.e., cure without medicinal treatment, are so small as to be almost negligible, and therefore the occurrence even of a single epileptic fit calls for an assiduous and prolonged course of treatment. One epileptic fit favours the occurrence of another, since the fit increases the instability of the cerebral cortex. In female patients, puberty and the menopause, so far from exercising a beneficial influence on the fits, as has been popularly supposed, have quite a contrary effect. Both of these physiological crises are associated with profound disturbance of metabolic equilibrium, during which any irritability of the cerebral cortex is more likely to be increased than diminished, and, in fact, puberty is a specially common time for epileptic fits to commence. Sometimes infantile epilepsy ceases spontaneously at the age of four to five years, but this cannot be held out as a probability in any individual case. As a rule, the later in life the disease appears, the greater are the chances of spontaneous arrest. Marriage of an epileptic has no material influence on the disease, either beneficial or otherwise. Pregnancy sometimes arrests the fits temporarily, but they generally return after the pregnancy is over.

The Danger to Life in idiopathic epilepsy is not great, despite the alarming appearances presented by the epileptic patient during the actual fit. Status epilepticus (where one fit follows another in rapid succession without the patient recovering consciousness between the individual fits of the series) is relatively rare, but it may be fatal from exhaustion and heart failure. The chief practical risk to life is that the epileptic patient may die accidentally, during a fit—most commonly by drowning through falling into water, an inch or two being enough to prove fatal, since the fit prevents the patient from making any effort to save himself. Other epileptics may die from asphyxia, by rolling over on the face in bed during an attack. Others, again, may inhale food into the air-passages, if the fit occurs during a meal ; or vomited material may be inhaled, with the same result. These, however, are secondary ‘accidents’ ; so also are the frequent injuries to the head and face sustained during falling, and the occasional burns which result from falling on to a fire. All of these ‘accidents’ can be obviated only by close watching of the patient and never, under any circumstances, leaving him unobserved.

Prospects of Cure or Arrest by Treatment.—Epilepsy is one of the diseases in which medicinal treatment often succeeds in profoundly modifying the disease, either by diminishing or abolishing the attacks, or by altering the type of the paroxysms during the time that treatment is persevered with. The prognosis in any individual case depends largely upon the personal reaction of the patient to the remedies prescribed, and the assiduity with which these remedies are administered. Even where the fits do not entirely cease, treatment may sometimes enable a patient to live an active and useful life in place of an existence which is distressing to the patient himself and to those on whom he is dependent. From a series of cases observed by Gowers, the following main conclusions were drawn in regard to factors affecting the outlook :—

Age.—The younger the patient at the age of onset, the less is the prospect of cure. Cases beginning between the ages of ten and twenty have relatively the worst prognosis ; those beginning before the age of ten are somewhat more favourable. The most favourable are those which commence after the age of twenty (with the exception already referred to, viz., that cases beginning in women at the menopause have an unfavourable prognosis).

Sex.—The prognosis is slightly better in males than in females, possibly owing to the intercurrent factors of menstruation and of the menopause in the female sex.

Previous Duration of the Disease.—The shorter the duration, the brighter are the prospects of its yielding to treatment. Cases which have lasted for less than a year are the best of all; if the disease has existed for five years or less, the chances are only fair; if the fits have been occurring for more than five years, complete arrest is almost unattainable, and we usually have to be content with a mere diminution in their frequency.

Intervals between Attacks.—Severe attacks, when occurring daily, are unlikely to be arrested. Attacks occurring at intervals longer than a month have the most hopeful prospect. Attacks occurring regularly once a month, in relation to a menstrual period—whether before, during, or after each period—are relatively more difficult to arrest than those where the attacks occur at somewhat shorter, but irregular, intervals.

The Waking or Sleeping State, during which the fits habitually occur, is of importance. If the attacks occur only in the waking state and not during sleep, or only during sleep but not when awake, the prospects are three times as bright as when they occur both asleep and awake. The prognosis is rather better in pure nocturnal than in pure diurnal epilepsy.

The Major or Minor Character of the Fits has to be borne in mind. Major fits are much more easily influenced by treatment than minor fits. It is not uncommon for the minor fits to persist, in spite of treatment, after the major fits have been completely arrested. The minor attacks may even become more frequent. Nevertheless, it is of supreme importance to persevere with treatment, since, if it be suspended, the major fits are almost certain to reappear.

Hereditary Disposition to epilepsy, contrary to expectation, does not appear to render the epileptic patient less amenable to treatment. Gowers has been strongly impressed with the frequency with which hereditary cases responded successfully to treatment.

Mental Change, whether dullness or irritability, is an unfavourable sign. We must bear in mind that some cases of apparent mental dullness in epilepsy may be due to excessive bromide medication.

The Occurrence of an Aura appears to render the prognosis slightly more favourable; possibly because, in such cases, the patient may sometimes be trained by an effort of will to fight, during the time of the aura, against his threatened fit. The precise variety of aura appears to have but slight significance in this respect.

The Apparent Exciting Cause of the first Fit is occasionally of importance with regard to prognosis. Thus, I remember one case in a young medical student, in whom a first and only epileptic fit occurred during the excitement of an election free-fight. The patient avoided exciting meetings thereafter, and never had another fit. I have also seen a number of cases, chiefly in adolescents, in which some unusual article of diet (e.g., salmon, ice-cream, sausage, etc.) had been consumed at the meal immediately preceding each attack, and at no other time; in others, each fit was preceded by a definite attack of constipation. Such classes of patients chiefly consisted of cases in which the fits occurred at long intervals of months, and even of several years. Attention to the diet and careful regulation of the bowels are of importance in every epileptic patient. Frequently, however, no constant exciting cause can be traced, and its presence or absence does not appear very materially to influence the prospect of cure.

The ultimate prognosis depends upon the patience and assiduity with which the patient and his friends can be induced to carry out the treatment. Treatment, dietetic, hygienic, and medicinal, must be persevered with for a long time after the fits have ceased. Two years without a fit is commonly agreed to be the shortest period that should elapse before treatment is relaxed. Even then, the bromide should not be withdrawn suddenly, but gradually, grain by grain, so as not to expose the brain to sudden stress.

J. Purves Stewart.

EPILEPSY, TRAUMATIC.—(See HEAD INJURIES.)

EPITHELIOMA—(See under Various Organs.)

EPULIS.—(See JAWS, TUMOURS OF.)

ERYSIPELAS.—A simple attack of cutaneous erysipelas, in a healthy person, is almost free from danger. The inflammation usually lasts about a week. Recurrence is not uncommon in those cases which appear to be independent of a wound.

Extensive cases, or those occurring in infants, the aged, sufferers from Bright's disease or diabetes, or alcoholics, are of much graver import. High fever and delirium, and the development of pyæmic abscesses, point to a probable fatal issue.

The mortality in 875 cases at St. Bartholomew's Hospital, a good many years ago now, was 3·5 per cent, being rather heavier in males than females. When there was definite cellulitis as well as erysipelas, the mortality was much higher: 11 per cent in 889 cases.

With regard to the effects of treatment, some attempts have been made to show that the attack is shortened by the local application of collodion (Avata and Woodyatt) and also by polyvalent antistreptococcic serum given internally (Basset). The collodion was used in 23 cases, and it was claimed that the average duration of the febrile period was shortened from 8 to 3·5 days, and complications reduced from 15 per cent to none. In 10 cases in which the serum was given, the average number of days required for cure was 4·7.

REFERENCES.—Avata and Woodyatt, *Jour. Amer. Med. Assoc.* 1918, Sept., 900; Basset, *Presse méd.* 1919, May, 237.
A. Rendle Short.

ERYTHRÆMIA.—(See POLYCYTHÆMIA.)

EXOPHTHALMIC GOITRE.—In this disease it will be necessary to investigate the results of various forms of medical treatment; of surgical treatment; the dangers to which the patients are liable; and finally, the factors that make for a good or a bad prognosis. It must be clearly stated at the outset that cases of simple goitre with quick pulse due to a little hyperthyroidism are not included in the tables given in this article.

RESULTS OF MEDICAL AND SURGICAL TREATMENT.

PARTICULARS		Total cases	Died in hospital	CASES FOLLOWED THROUGH					
				Total followed through	Cured	Much better	Better	No better	Died since
MEDICAL	1. Hale White (hospital) - -	161	per cent 11	48	per cent 54	per cent 0	per cent 25	per cent 5	per cent 16
	2. " " (private) - -	55	0	54	64	0	17	6	13
	3. Campbell (Guy's 1908-17) -	127	6	73	45	—	40	15	—
	4. Rogers (antithyroid serum) -	480	0	240 (?)	30	20	0	34	16
	5. Jackson and Eastman (quin. HBr) - -	56	0	56	76	0	13	11	0
	6. Stoney (x rays) - -	200	0	172	45	40	—	15	—
	7. Burrows and Morison— (x rays) - - -	—	—	100	27	49	20	4	—
	(radium) - - -	—	—	100	20	20	40	20	—
SURGICAL	8. Porter (hot-water injection) -	22	0	20	—	84	—	16	1*
	A. Partial thyroidectomy:								
	1. Kocher (progressive Graves') -	539	3	360†	45	0	41	8	6
	2. Kuttner - - -	64	17	37	34	36	17	14	0
	3. St. Thomas's Hospital (1910-16) - -	28	35	14	—	14	—	86	0
	4. Berry (1913-19) - -	79	3·8	74	72	24	—	4	—
	5. Walton - - -	101	5	—	52	—	23	—	—
	6. David (Chicago Hospital) -	200	5·5	65	38	40	—	18·4	?
	7. Judd (1909 cases) - -	176	4	121	45·4	18	7	13	12
	(1914 cases) - -	100	2	90	66	13·5	5·5	2	13
	B. Ligature of arteries:								
	1. Mayo - - -	225	2	115	2	48	9	31†	9
	2. Berry - - -	42	0	—	—	—	—	—	—
	C. Sympathectomy:								
	Boisson - - -	27	11	15	13	40	20	7	20

* Died of cancer. † Many of these had more than one operation.
‡ Most of these had a subsequent thyroidectomy.

Medical Treatment.—The tables that have been published, giving end-results, require examination before they can be generally accepted. Some authors are over-enthusiastic on behalf of a special mode of treatment; others are meagre in details. Perhaps Sir Hale White's¹ statistics command most confidence, full particulars being given for each case, based almost entirely on a communication from the patient herself or her medical attendant. The treatment was very diverse, including digitalis, belladonna, arsenic, thymus, Moebius' serum, and other drugs; most of the private cases were ordered prolonged rest in bed, which Sir Hale White considers of the first importance. It must be borne in mind that the mildest cases would not be adequately represented in these figures, as such would not be so likely to become hospital in-patients or to seek the consultant.

It will be observed that about 11 per cent of Sir Hale White's hospital cases died in the institution; that of those followed through, more than half recovered more or less completely, a quarter improved, a few remained *in statu quo*, and about 16 per cent have since died. The private cases did decidedly better, about 64 per cent recovering, while only 13 per cent died subsequently. Most of these patients have been followed up for several years. With reference to those who have died since, the mortality appears to be about double that of healthy females of the same age.

The Guy's Hospital figures have been brought down to 1917, in continuation of Sir Hale White's work, by Campbell.¹⁵ Of 127 cases, 8 died in hospital of the disease or complications thereof; about 80 were traced, and showed 7 completely cured, 26 almost cured and able to live a normal life, 29 much improved and doing a little work, and 11 improved slightly or not at all. These figures differ very little from those of the earlier period, except that rather fewer are known to have died.

Rogers² presents figures, without full details, illustrating the results obtained by the use of his antithyroid serum. No doubt rest and regimen must bear a share in the credit. The treatment does not appear to improve upon the success obtained by other methods. About 30 per cent are quite cured, and one-half altogether experience great improvement. The percentage of those not improved is high.

Jackson and Eastman³ publish statistics of treatment by neutral quinine hydrobromide, in addition to rest and general supervision, and the percentage of cases cured or greatly benefited is high; the details, however, are meagre.

There is no convincing evidence favouring any special drug treatment, and it would appear that of cases sufficiently ill to require hospital treatment or a specialist's opinion, about half get well or almost well, 25 per cent improve, about 15 per cent do not improve, and the mortality-rate is about twice the normal. Hector Mackenzie declares that bromides and belladonna may help some cases, but that neither the milk nor the serum of a thyroidectomized goat, nor rodagen, works any improvement.

The end-results of *x*-ray treatment⁴ compare favourably with other methods, if we may be sure that Dr. Florence Stoney's¹⁵ patients classified as 'much better' were more relieved than those spoken of by Sir Hale White as 'better,' which seems precarious; but the proportion of 'cases' and 'no better' is about the same. She reports 200 treatments; 78 were cured, 66 much better, and 28 no better. It cannot therefore be regarded as proved that the *x* rays are a great advance on other treatment. Another series is reported by Burrows and Morison.¹⁶ Of 100 consecutive cases, 27 were 'cured', 49 much better, 20 better, and 4 not improved. They admit that it is principally the mild cases that benefit. Radium was also tried, but did not give such good results. Mackenzie reports a case in which 36 applications of *x* rays over a period of four years converted an exophthalmic goitre into myxœdema, which was cured by thyroid feeding. The treatment must be prolonged. A drawback of the method is that telangiectases and burns may occur. Mackenzie, at one time an advocate of *x*-ray therapy, has since been disappointed in it.

Another comparatively new method is to inject each lobe with about 3 drachms of boiling water, under local anæsthesia of the skin. According to Porter,⁵ this will cure mild cases and ameliorate severe ones. He uses it as a preliminary to operation when the patient is too bad to undergo a thyroidectomy. Several injections are given at weekly intervals. Of 22 cases, 16 were more or less completely relieved, and only 3 did not improve. The others were lost sight of; one died of cancer. English authorities do not take this method very seriously.

Surgical Treatment.—This had until recently made far more headway on the Continent and in America than in England, where it had the misfortune to be practised in the first place on some totally unsuitable cases, with an appalling mortality.

Three operations have been used: complete or partial excision of the sympathetic ganglia of the neck, or section of the connecting nerves; ligature of the superior thyroid arteries; and removal of one-half of the thyroid gland.

Data concerning cases of sympathectomy, followed up afterwards, and dealing only with instances of undoubted Graves' disease, are not easy to find. Boisson⁶ has published a record of 15 answering to this description, of whom 2 were cured and 6 greatly improved, but it is not clear that the benefit followed very closely on the operation. Out of 27 operated on, 3 died soon afterwards. The rationale of the treatment is open to doubt, and it is said that blindness may follow. Probably no one operates by this method at the present time.

Although the Mayos proceed to remove half the thyroid at a second operation if the first is not successful, they publish figures⁷ giving the end-results of cases in which the treatment adopted has been *ligature of the superior thyroid arteries*. The details are scanty. The operation mortality was only 2 per cent. A few cases were cured; about half were greatly improved, but about a third were either not improved or had to submit to the second operation of hemithyroidectomy. Nowadays this procedure is only regarded as preparatory to removal of part of the thyroid. Berry reports 42 operations with no deaths; sometimes the relief was sufficient to make the severer operation unnecessary.

In the majority of Kocher's cases *half the gland was removed*.⁸ He divides his patients into two groups; in the first there are symptoms of hyperthyroidism which are neither permanent nor progressive, associated with a parenchymatous or adenomatous goitre. Except that two patients died of pneumonia (out of 130), the results of operation were uniformly good. In the second group of 539 cases there were progressive symptoms of Graves' disease; here the mortality was 3 per cent. He laid great stress on the use of a local anæsthetic. Although the majority of the patients had been suffering long and severely, nearly half were completely cured even when watched for many years, but they often required more than one operation, the first removal having proved too limited. The cases classed as 'better' were able to earn their living; these amounted to 41 per cent.

Kuttner's⁹ figures are about equally favourable, although he admits a much higher mortality (11 out of 64).

In two London hospitals, Guy's and St. Thomas's, quoted by Sir Hale White and Mackenzie, the results were dreadfully bad, but it is probable that they represent a much severer type of case which the Continental and American surgeons would have refused to touch. One-third of the patients died, and although the majority of those who survived were improved, several were not benefited, and only one was absolutely cured. A more recent series from St. Thomas's hospital, for the period 1910-16, quoted by Mackenzie, shows no improvement; 10 out of 28 patients died, mostly within twelve hours of the operation, and only 2 of 14 cases followed up were markedly better.

Berry,¹⁰ however, has published two far more successful series of cases. In the first, he operated on 28 patients, including one who died on the table before the first incision was made. Two others died within a few days; 25 recovered well, and of these all were benefited, some to a most remarkable degree, but others relapsed. Every one of these patients had marked Graves' disease, with exophthalmos.

A second series, 1913 to 1919,¹⁵ treated by hemithyroidectomy, shows a mortality of only 3 in 79 operations. Of the cases followed up, 53 are practically well, 18 much improved, and 3 no better. It is common for the patient to experience great relief within a day or two of the removal of the gland, but there is some tendency to relapse.

Other recently published figures show a steady improvement, due partly to better selection and partly to better technique. Walton's¹¹ series of cases operated on by himself shows a death-rate of only 5 in 101, this favourable result being obtained by exercising great care in choosing the type of patient and time of operation, and by 'stealing' the gland after the manner of Crile. Of the patients followed up, 52 were 'cured'—that is, free from symptoms, though in some the pulse was 100—and 23 were better. He followed most of these for periods of one to four years. He points out that there is often great

immediate improvement, then a partial relapse a few weeks later, then more or less permanent improvement after three or four months.

David¹² reports a series of 200 patients operated on by various surgeons at the Chicago Presbyterian Hospital, between 1905 and 1914, of whom 11 died. Of 65 cases followed up in 1915-16, 38 per cent seemed to be cured, 40 per cent much better, and 18.4 per cent little, if any, better. He points out that the exophthalmos is difficult to influence. Judd¹³ gives the end-results, investigated six years later, of two series from the Mayo clinic. The first relates to 176 cases operated on in 1909, and the second to 100 operated on in 1914. Of the former series, 7 died in hospital and 14 since; of 121 followed up, 45.4 per cent were quite well and 18 per cent nearly so, 7 cases were better, 5 a little better, and 8 not improved. In the second series, 2 died in hospital and 13 since; two-thirds were cured. Treatment was generally ligature of arteries followed later by removal of one lobe or more. Judd¹⁴ points out that operative deaths are generally due to bad selection of cases, the most dangerous being those in which the symptoms are rapidly progressing. As Dunhill remarks, hemithyroidectomy is not always enough; it may be necessary to operate again and remove more.

The immediate dangers of operation are considerable. The patients take a general anæsthetic very badly, and a good many have died on the table; on the other hand, the pitiable nervousness makes the strain of operation under local anæsthesia great, and Kocher admits that a considerable number are very much upset, with rapid pulse, fever, and other alarming symptoms. Again, patients with exophthalmic goitre have frequently an enlarged thymus, which may precipitate sudden death. Interference with the gland may lead to a profuse outpouring of thyroid secretion into the veins, with symptoms of acute hyperthyroidism, including very rapid irregular pulse, fever, delirium, and increased exophthalmos: this may end in death within a day or two. The patients stand hæmorrhage, even of slight degree, very badly. Crile's anoci-association methods, and the administration of large quantities of saline per rectum, may help to avert these dangers. (See also ANÆSTHETICS, p. 34.) Occasionally tetany has followed, from injury or removal of the parathyroid glands; also paralysis of the recurrent laryngeal nerve.

Comparison of Results of Medical and Surgical Treatment.—We may conclude, briefly, that under medical treatment, of 100 patients, traced for five years or so, 15 will die of the disease, 10 go on for years without much change, 25 will improve, and 50 will get nearly or quite well. Probably *x* rays will not alter this much; there may be more improvements, and some mild cases may clear up better. After operation, the early and late mortality together have also been about 15 per cent, and the proportion of cases cured, better, and no better is about the same. One benefit, however, is not brought out by figures: the medical treatment is long and tedious, whilst the operation, if successful, leads to a much quicker cure. Hector Mackenzie,¹⁵ long an opponent of surgical treatment, has recently been convinced by Dunhill's results, with a local anæsthetic. He has had several hundreds of his patients operated on with a mortality of only 2 per cent. He states that he knows no other treatment available at the present time which offers so good a prospect of restoration to health and vigour. To obtain best results from surgery, cases must be taken at the favourable time. As the Mayos and Berry have pointed out, the toxæmia advances to a certain degree, attains a maximum usually towards the end of the first year, and then subsides, and the proper time for interference is either early or late, but not at the height of the toxæmia. It is dangerous to operate on patients with a markedly dilated and irregular heart, great muscular prostration, great excitability, persistent albuminuria or glycosuria, or lymphocytosis with leucopenia. Marked mental symptoms also contra-indicate. A useful test of muscular prostration is whether the patient can step up on to a chair or not. Great emaciation, however, is not a contra-indication *per se*. Patients who are fairly free from symptoms ought not to be subjected to operation.

When there is doubt as to the patient's ability to stand an operation, it will be wise to content oneself with ligature of the superior thyroid arteries, proceeding to hemithyroidectomy at a later date if necessary.

With proper selection of cases, and in the best hands, the operation mortality now is not above 5 per cent. The Mayos have had a consecutive series of 278 cases without a death.

Sequelæ.—Like other chronic invalids, patients are liable to various chest complaints, and also to profuse or uncontrollable *diarrhœa*. In many of Sir Hale White's hospital cases, vomiting or diarrhœa was responsible for the fatal issue; in his private practice, where the patient is more likely to be put to bed and to be suitably fed from the first, this complication was much less in evidence.

Nervous Symptoms, such as delirium or coma, are not uncommon at the termination, and usually point to a rapid dissolution. Mania or melancholia may also occur.

Cardiac dilatation is fairly frequent, and acute attacks may lead to sudden death. A mitral murmur may appear.

Rarely, the exophthalmos so increases that *ulceration of the cornea*, or even blindness, may result, or the eye may be dislocated forwards on to the face.

Glycosuria is not uncommon, and several of Sir Hale White's cases died of diabetes. In other patients, intervals of hypothyroidism (myxœdema) alternate with periods of hyperthyroidism.

Relapse may occur even after many months or years of apparently perfect health. In one case known to the writer a relapse was induced after more than twelve years of entire freedom from symptoms; the first attack was brought on by a head injury and the second by iodoform poisoning. In the great majority of instances, however, relapse does not occur if once complete freedom from symptoms is obtained for any length of time. Patients stand confinements very well, even if the disease is still present in mild degree. Many so-called relapses are really exacerbations of symptoms which had only partially subsided.

Prognosis in Individual Cases.—In Sir Hale White's tables, the cases are grouped according to the severity of the symptoms and the eventual result. We combine the hospital and the private patients here.

	Mild or average	Severe	Very severe
Cases that have done well -	36	16	9
Cases moderately well, or better	16	4	1
Cases that did not do well -	4	1	0
Total	56	21	10

Many of Kocher's successful cases were very ill; in one of these the eyeball had prolapsed and had to be replaced, yet the patient is now quite well, with no exophthalmos. Severity of the ordinary symptoms, then, does not make a bad prognosis. Cases that come on acutely usually get well rapidly, even if they become very ill for a time.

There are certain danger signals. *Diarrhœa* and *vomiting* that do not yield soon to rest in bed and suitable feeding are of grave import. *Delirium* or *coma* usually heralds a rapidly fatal termination. The most significant sign is probably the *wasting*; prognosis improves or depreciates with the patient's weight.

Cases supervening on a chronic goitre are usually mild in type, but long-lasting.

It is almost impossible to foretell how long a patient will be ill. Six to eighteen months is a very ordinary time, but many cases drag on for years. When the weight is steadily falling, the outlook is less favourable; when it is steadily rising, the patient is usually within a few months of the end of her troubles.

A few cases are on record, especially in children, in which the symptoms came on rapidly in a day or two, and as suddenly disappeared after a few weeks or less. As a rule, children do better than adults, and women better than men.

It is quite common for some degree of permanent indurative swelling of the thyroid and slight prominence of the eyes, due to fatty accumulation in the orbits, to persist even after recovery.

Summary.—1. Under medical treatment, with or without *x* rays, of 100 patients traced for five years, 15 will die, 10 will go on unchanged, 25 will improve but not get well, and 50 will get nearly or quite well.

2. The mortality of hemithyroidectomy, in best hands and with proper selection of

cases, is not above 5 per cent. The proportion of patients cured, better, and not relieved is much the same as in those treated by medical means, but the improvement is obtained in a much shorter time.

REFERENCES.—¹Hale White, *Guy's Hosp. Rep.* vol. lxxv. 1911, 1; ²Rogers, *Ann. of Surg.* 1909, Dec., 1023; ³Jackson and Eastman, *Boston Med. and Surg. Jour.* vol. 163, 1910, 419; ⁴Stoney, *Brit. Med. Jour.* 1912, ii, 476; ⁵Porter, *Jour. Amer. Med. Assoc.* 1914, lxi, 88; ⁶Boisson, *Etude critique des interventions sur le sympathique cervical dans la maladie de Basedow*, Paris, H. Jouve, 1898; ⁷Mayo, *Ann. of Surg.* 1909, vol. i, 1018; ⁸Koehler, *Lancet*, 1912, i, 576; ⁹Kuttner, *Rev. de Chir.* 1911, 1031; ¹⁰Berry, *Lancet*, 1913, i, 583, 668; ¹¹Walton, *Practitioner*, 1917, Oct., 309; ¹²David, *Ann. of Surg.* 1916, Oct. 400; ¹³Judd and Pemberton, *Surg. Gynecol. and Obst.* 1916, xxiii, 269; ¹⁴Judd, *N. Y. State Jour. of Med.* 1920, xx, 289; ¹⁵Debate, *Roy. Soc. Med.* 1921, Feb., Mackenzie, Berry, Stoney, Campbell, Walton; ¹⁶Burrows and Morison, *Proc. Roy. Soc. Med.* 1920, xii (Elect.-ther. Sect.), 132; ¹⁷Berry, *Brit. Jour. Surg.* 1921, April, 413.

A. Rendle Short.

EXTRASYSTOLES.—(See PULSE, IRREGULARITIES OF.)

EXTRA-UTERINE GESTATION.—(See ECTOPIC PREGNANCY.)

FACIAL PARALYSIS.—(See NERVE INJURIES.)

FEMUR, FRACTURES OF.—(See FRACTURES; GUNSHOT WOUNDS.)

FIBROIDS.—(See UTERUS, FIBROIDS OF.)

FILARIASIS.—Filariae may be commonly present in the human body without producing any symptoms. The chief danger is secondary septic infection, which may cause death after prolonged fever. Filariæ abscess, lymphangitis, chyluria, and elephantiasis are rarely fatal of themselves apart from septic and other complications.

The secondary micrococcal infections with resulting severe febrile paroxysms may be combated with advantage by means of autogenous streptococcal vaccines (Rose and others).

Chyluria has been reported to prove fatal through leakage into the peritoneal cavity.

Leonard Rogers.

FRACTURES.

SIMPLE FRACTURES.

The world war, in its profound effects on civilization, very naturally brought a heavy pressure on the resources and scientific efficiency of the medical profession, and hardly any department of medicine or surgery has received greater demands on its abilities than the department of surgery which deals with fractures. Compound fractures in all grades of severity were continuously under treatment, and no doubt, now that the war is over, much information will be available and much useful knowledge acquired. As compound fractures are rarely suitable for the operative method, the older form of splint treatment is largely and effectively used. The Thomas splint and its various modifications have achieved a well-deserved popularity in war surgery. The very valuable caliper-extension methods of Pearson and Watkin Williams must also be given a place of honour.

The Report of the American Surgical Association, 1915, deals with 1745 cases—1358 non-operative and 387 operative. Of the latter, 258 cases of simple fracture and 129 cases of compound fracture were operated on. These numbers are disappointingly few. They are set out in table form for comparison with the British Medical Association Report, 1912 (see below).

Before entering on a detailed consideration of the end-results of various fractures, it may be well to emphasize the fact that surgeons and practitioners for some years have had a growing consciousness that the available methods of treatment have not always yielded results which can be described as satisfactory. It is platitudinous, but nevertheless true, to say that the utility of a bone after a solution of its continuity depends in a measure on the nature and extent of the traumatism. If this is severe, then a complete reconstitution with a good functional result cannot always be expected.

It is quite obvious that there has been, and is, a constant effort to obtain good results on the non-operative side, operative methods apart for the moment, as witness

the wonderful inventions which lumber up the splint rooms of hospitals, rusty worm-eaten evidences of the difficulty and disappointment which attend treatment. Nearly thirty years ago, M. Lucas-Championnière¹ began to issue his protest against rigid and prolonged splint or plaster fixation; he remained until his death the grand protagonist of the school of treatment by mobilization and massage. Few now apply this method in its entirety, but all recognize its great importance as an accessory to any mode of treatment.

The extension methods of Bardenheuer are becoming more known in this country, and those who have mastered the application of the apparatus speak highly of the results. The Bevan fracture bed in use at the Blaina Hospital, Monmouthshire, is particularly useful for this form of treatment.

The nail-extension method of Steinmann would appear to take a place between non-operative and operative practice, but its employment does not seem to be sufficiently general at present to enable an opinion to be formed. Finochietto's extension stirrup is an adaptation of this principle, and has strong advocates.

Ewald² issues a word of caution in respect of the Steinmann method; he says that the results from the point of view of the fracture were satisfactory if not brilliant. He had used the nail in 29 cases of fracture of the lower limb; in 18 cases the perforations healed in from two to four weeks, but in 9 cases he has had an infection which lasted from five to twelve months, and in one case it was necessary to open an abscess at the end of two years. Ewald also warns us against using too large a nail in the calcaneum, and observes that the nail must be exactly in the middle of the bone or there is risk of fracture.

A new school has evolved which contends that accurate anatomical reconstitution, and consequential good functional results, can best be achieved by operative treatment. This school, most ably led by Sir Arbuthnot Lane, Dr. Lambotte, and others, energetically rejects for many fractures the non-operative and the older operative methods, and bases its case on the application of a plate, screw, encircling wire, fixateur, intramedullary splint, or bone inlay to the fracture, accurately reduced by free incision.

These differing systems of treatment show that all is not well, and that prognosis must be guarded.

The new light on the subject afforded by radiography, and the inquiries under the Workmen's Compensation Acts, reveal the good or bad results of the various methods. The report of the late Mr. Clinton Dent,³ "On the After-effects of Injuries", in which he states that he had difficulty in remembering a case of Pott's or Dupuytren's fracture which had sufficiently recovered to resume police work, came as a shock to the profession.

The universal desire for an inquiry into the ultimate results obtained in the treatment of simple fractures was voiced at the meeting of the Surgical Section of the British Medical Association in London, 1910. Pursuant to a resolution there passed, the Council of the Association appointed a Committee, whose report appeared in the *British Medical Journal*, November, 1912. In this report we have contrasted non-operative and operative methods, and it must form the basis of any discussion on the prognosis of fractures for some time to come. The number of cases on which the report is founded is 2940; this does not include the cases investigated abroad, which are set out separately.

Amongst the important conclusions of the Committee, one finding stands out prominently, taking operative and non-operative cases together, namely, that if a good functional result is to follow, a good anatomical position must be attained. We find good functional use accruing in 90·7 per cent of cases when this latter is achieved. When the anatomical results are moderate or bad, we find only 29·7 per cent of good functional results. When the anatomical results are bad, we note 53·3 per cent of bad functional results. This shows the importance of endeavouring to obtain a good anatomical reconstitution.

A consideration of the age-group tables in the report affords further useful information. In the non-operative cases under 15 years of age, there was a good functional result in 90·8 per cent, as compared with 45·4 per cent in cases over 15.

In the operative cases belonging to the class in which operation was decided on at once and performed as soon as practicable, we find that under 15 years there was a good functional result in 93·6 per cent. In those over 15 years, operation gave a good

functional result in 66·3 per cent. This shows the distinct superiority of operative as compared with non-operative methods. The operative cases are few relatively to the non-operative; hence it is not advisable to dogmatize on the greater excellence of operative results. Still, it may be assumed that as the older operative methods on the long bones, such as wiring, etc., become discarded, and more operative cases become available for comparison, even better results may be looked for in the future.

Dujarier⁴ reports that in 32 cases of operative intervention for fractures of the leg, recent or old, he has not had a check; all his patients are consolidated and walking. The operations were carried out between 1904 and 1912.

Fredet⁵ records his experience of operation in 20 cases, following the technique of Lambotte; he expresses himself as fully satisfied with the results.

Darrach⁶ reports that of 2100 fractures treated at the Roosevelt Hospital, 5 per cent required operation. His results of operation on recent fractures were: ideal 71 per cent, fair 21 per cent, bad 8 per cent. In old fractures, operation gave: ideal 30 per cent, fair 47 per cent, bad 23 per cent.

The method of inserting a bone-graft, generally from the tibia, in ununited fractures is coming into favour, due very largely to the peculiarly attractive advocacy of the late J. B. Murphy. Albee⁷ reports 15 successful cases.

In Table VI of the British Committee's report, given below, three fractures are considered, and the percentages of good functional results (apart from consideration of the anatomical result) are given. It will be seen that there is a diminishing number of good results in each group as age increases. In the words of the report, "there is a progressive depreciation of the functional result of non-operative treatment as age advances; the older the patient the worse the result."

PERCENTAGES OF GOOD FUNCTIONAL RESULTS FOR EACH AGE GROUP.
(B.M.A. REPORT, *Table VI.*)

(Three Fractures.)							
TIBIA AND FIBULA. SHAFTS		RADIUS AND ULNA. SHAFTS		POTT'S			
Ages	per cent	Ages	per cent	Ages	per cent		
0-10	- - 93	0-10	- - 72	0-10	- - 100		
11-15	- - 95	11-15	- - 52	11-15	- - 100		
16-20	- - 81	16-20	- - 50	16-20	- - 50		
21-25	- - 77	21-25	- - 50	21-25	- - 54		
26-45	- - 65	26-45	- - 28	26-45	- - 54		
46-60	- - 57	46-60	- - 28	46-60	- - 38		
61-	- - 50			61-	- - 30		

Table V of the A.S.A. report deals with the percentages of good functional results for the age groups, and is in full agreement with Table VI of the B.M.A. report. The comment is as follows: "In patients under 15 years of age, good functional results depend less upon good anatomical results than in older patients, and the bad functional results are almost negligible, 3 per cent. The older the patient the greater is the proportion of bad results, and the more certainly do such bad results follow failure to secure anatomical reposition of the fragments. The proportion of good functional results secured from moderate and bad anatomical results grows progressively less the older the patient." This gives a clear indication of the importance of endeavouring to secure good anatomical results.

In the tables which follow, when cases are spoken of as having a good anatomical and a good functional result, it means that the result is perfect, or nearly so. The result we should all aim at is a good anatomical and a good functional restoration of a limb. The percentage of these achieved by non-operative and operative treatment will be readily found in the tables, and those who require this high standard in their work will turn to the figures headed "Good Anatomical and Good Functional Results."

In respect of fractures in the neighbourhood of joints, the A.S.A. reporter comments that it is much more important to secure a good anatomical result in fractures involving joints than in fractures of the shafts of long bones; in shaft fractures a bad result follows in about half the cases, whereas in joint fractures a bad anatomical result ensures a bad functional result in three-fourths of the cases.

In further reference to the prognosis of fractures in the neighbourhood of joints, the recent important thesis of M. Siauve⁸ contains the following cogent conclusions :—

The prognosis of intra- and juxta-articular fractures is most grave. Those involving the ankle, wrist, and elbow have as a result more or less functional weakness, the cause of this being imperfect coaptation of the fragments, and the resulting exuberant or vicious callus, which destroys the normal play of the articular surface. The insufficiency of ordinary treatment is thereby demonstrated. In the hands of specialists the ordinary measures may sometimes be sufficient, but no matter in whose hands, the results are often bad.

Surgical treatment should be undertaken more often than is usually done. The reason this latter is not generally accepted is because the surgery of bones is far from having arrived at perfection, especially that which concerns articular and juxta-articular fractures. This method is capable of being perfected, and will be in the future. The usual methods have said their last word, and remain to-day as they have for long been—insufficient.

Whether or not these weighty words will be modified, the future experience of surgeons and practitioners alone will declare. For the present the older or non-operative methods remain “safe and serviceable”. Truly the results are not of the best; accurate reconstitution, at any rate in adults, cannot always be attained and maintained. Patients will be satisfied with fair functional results, and practitioners will hesitate to recommend a cutting operation. That the operative method offers the nearest approach to scientific accuracy in reconstruction there can be no doubt; at present it is in the hands of experts, but with a more general diffusion of knowledge the treatment will be more widely applied.

A criticism put forward by some opponents of the operative method, but which is not yet proved, is that there is greater delay in the process of consolidation than under non-operative methods. Even if this turned out in the event to be correct, it can hardly be a serious objection, as it would seem to be more important that a workman should return to work with a straight, well-reconstituted limb, even after a somewhat longer convalescence, than that he should return earlier with an irregular and consequentially weak limb, with the greater probability of a breakdown. W. L. Estes, junior,⁹ gives a study of the causes of delayed union and non-union in fractures of the long bones. He writes of: (1) Normal union; (2) Delayed union; (3) Non-union. A note of the time of union of uncomplicated fractures for each region was made. A majority was found to fall between certain limits. All fractures found to require approximately eight days more for union than the upper normal limit were regarded as showing delayed union; for example, in fractures of the lower third of the tibia, union was estimated as occurring normally in from thirty to forty-two days; all fractures requiring fifty days or more were considered to exhibit delayed union. Union was not to be confused with consolidation. Union was considered to occur when no vestige of abnormal mobility could be detected at the seat of fracture, and had no relation to the strength of the repair. If, after six months or more, the repair of bone had reached a standstill, and abnormal mobility still persisted, non-union was believed to have occurred.

In 64 cases of delayed union, the cause of delay has been ascribed to: (1) Comminution, 6; (2) Compound fracture, 34—simple 4, compound comminuted 15, compound comminuted infected 3, compound comminuted, osteomyelitis 12; (3) Plating alone, 6; (4) Late open reduction, 3; (5) Mal-union from incomplete reduction, 4; (6) Undetermined, 9; (7) Plating for comminuted fracture infection, 1; (8) Multiple fractures, 1. Syphilis existed in three cases.

It is to be observed that in the above list plating is said to be accountable for six cases of delayed union, all in the lower extremity. In 3 tibia and 1 femur cases previous attempts at non-operative reduction had been made and failed; operation undertaken at the third and fourth week after injury. The author states that it would therefore seem that plating in itself is accountable for delayed union in relatively few cases of simple fracture, possibly 8 per cent of the cases in which it has been used. Apparently this refers to all cases which have failed to respond to non-operative methods, and the consequent late operative work is assumed to cause delayed union. Clearly *post hoc* but not *propter hoc*.

TABLE SHOWING PERCENTAGE OF DELAYED UNION AND NON-UNION IN ESTES' CASES.

Site of Fracture.	No. of Cases	Delayed Union, per cent	Non-union, per cent
HUMERUS :			
Upper end - - -	15	—	—
Shaft, Upper third -	10	—	—
„ Middle „ -	12	16 $\frac{2}{3}$	8 $\frac{1}{3}$
„ Lower „ -	5	—	—
	— 27		
Lower end - - -	8	—	—
	—		
	50		
RADIUS AND ULNA :			
Upper end :			
Head of Radius - -	1	—	—
Olecranon - - -	5	20	—
	— 6		
Shaft, Upper third -	8	12 $\frac{1}{2}$	12 $\frac{1}{2}$
„ Middle „ -	9	33 $\frac{1}{3}$	—
„ Lower „ -	28	25	—
	— 45		
Lower end - - -	16	—	—
	—		
	67		
FEMUR :			
Upper end :			
Neck - - -	15	16 $\frac{2}{3}$	26
Trochanteric - - -	8	—	—
	— 23		
Shaft, Upper third -	13	15	—
„ Middle „ -	30	23	—
„ Lower „ -	12	41 $\frac{2}{3}$	—
	— 55		
	—		
	78		
TIBIA :			
Condylar - - -	1	—	—
Shaft, Upper third -	24	54	4
„ Middle „ -	43	30	2
„ Lower „ -	52	20	4
	— 119		
Lower end - - -	20	—	—
	—		
	140		
FIBULA - - - -			
	38	—	—

Dujadier reports¹⁰ that amongst 150 interventions for pseudo-arthroses he found 24 in the leg. He treated these with stout bone-grafts where there was loss of substance, and where there was no loss he used his own staples. Amongst these he had two suppurations, that is, two checks, in the cases under treatment, and 20 successes (90 per cent), consolidation being obtained in from two to four months.

Lambotte reports¹¹ that he has, since 1913, operated on 234 fractures, with a single death from pneumonia. This brings his total statistics to 751 cases of osteosynthesis. For fractures of the femur he has operated 161 times : 33 for fractures of the neck, 117 for fractures of the diaphysis, 11 fractures of the condyles. He is of opinion that, generally speaking, the operation is without gravity under rigid asepsis and with complete and efficient instruments. Emphasis must be placed on asepsis and efficient instruments.

On examining the report of the British Fractures Committee more closely, it will be seen that the non-operative treatment of fractures of the shafts of the long bones in children under 15 years (excepting fractures of both bones of the forearm) shows a high percentage of good results ; so it appears that operation is not a necessity in children.

The Committee point out that, as above indicated, the operative cases submitted for examination were few in comparison with the non-operative cases, and that it is undesirable on this ground to arrive at a verdict as between operative and non-operative methods. But if we take the operative cases as they are set out, we find that in cases treated by immediate operation, the deleterious influence of age upon functional results is less marked. In most of the age groups, operative treatment gives a greater number of good results than non-operative.

Another very definite finding of the Committee is that operative treatment should not be regarded as a method to be employed in consequence of the failure of non-operative methods, as the results of secondary operations (that is to say, operations on (1) cases in which there has been failure to obtain and maintain accurate apposition by means of external mechanical appliances, or (2) cases of non-union, or deficient or faulty union, compare very unfavourably with those in which operation was carried out as soon as practicable.

With regard to the important question of *mortality*, in fifteen hospitals 11,946 fractures of the long bones were treated non-operatively, with a death-rate of 1 per cent. The majority of the deaths were due to age, disease, or associated injuries. The number of cases treated by operation was 1040, with a death-rate of 0.77 per cent.

The causes which in the non-operative cases led to a fatal result, caused death in 5 of the operative cases. The death-rate directly due to operation is then 0.3 per cent. Dr. Lambotte's death-rate in 567 operations is 1.5 per cent; amongst these he includes operations for fracture-dislocation of the iliac bone, multiple fracture of the leg, double fracture of the femur, and a case of irreducible subtrochanteric obstetrical fracture of the femur in an infant six days old. Another case had appendicitis and evacuation of pus per anum. Most of the deaths are associated with the injuries, accidental or avoidable.

The American Committee recommend that as a general principle fractures should be treated by a skilled surgeon, and that the *x*-ray examination is of great importance and should be efficiently made. Further, that general anaesthesia should be employed to effect the reduction; that neither the operative nor non-operative method is to be recommended exclusively; each has its indications and should be employed when required; non-operative methods are especially effectual under fifteen years of age. This last is one of the very definite conclusions which emerged during the British Committee's inquiry. Again, if and when operative methods are decided on, they should be employed early. This also is in agreement with the British Committee's report. The American Committee recommend some rigid form of plate applied directly to the bone, or a bone inlay, as the best method of fixation in operative cases. There can be no doubt as to the soundness of this principle. Absolute mechanical fixation is essential. This has been abundantly proved by experience, and by the experimental evidence laboriously adduced by Hey Groves.¹² The bone inlay cannot always be relied on to maintain this fully; it certainly gives good results in suitable cases. The two Committees agree that the operative treatment should be undertaken only by surgeons of special experience and training, under the best possible aseptic conditions, and with an ample equipment ready to meet every emergency.

In commenting on the statistics obtained, the American Committee call attention to the fact that in the operative cases anatomical reposition was secured in less than 72 per cent of cases. The figures show that if good anatomical results are not obtained, but only moderate, better function follows non-operative than operative treatment. Probably those cases in which by operative means good anatomical results were not secured were difficult ones, or possibly late cases. At all events very few of the operative cases belong to the class in which operation is decided upon at once and is performed as soon as practicable. The American Committee observe that unless good anatomical results are obtained by operation, the slight improvement in the position of the fragments, short of perfection, does not compensate for the additional injury to the soft parts entailed by the operation. The conclusion is that unless the surgeon is reasonably certain of securing accurate anatomical results by operation, he will do better to leave the fracture unreduced.

The Committee remark that infection is the important question in the operative method; over 5 per cent of the whole operative series became infected during the

operation. While good operative results were obtained by good surgeons, the infected cases are not the sole property of bad surgeons. This is in harmony with the British Committee's finding.

Both Committees' reports are examined herein in some detail.

Femur.—

RESULTS OF NON-OPERATIVE AND IMMEDIATE OPERATIVE TREATMENT OF FRACTURES OF FEMUR. (B.M.A. REPORT.)

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
			per cent	per cent
Neck - - -	Non-operative - - -	91	16.4	9.8
	Operative - - -	1	100.0	—
Separated epiphysis of head	Non-operative - - -	9	44.4	22.2
	Operative - - -	—	—	—
Upper third of shaft	Non-operative, all ages	96	54.1	4.2
	Ditto, under 15 - - -	47	87.0	8.0
	Operative (all under 15)	3	100.0	—
Middle third of shaft	Non-operative, all ages	436	67.8	13.2
	Ditto, under 15 - - -	328	87.0	7.8
	Operative, all ages - - -	27	92.5	—
	Ditto, under 15 - - -	25	96.0	—
Lower third of shaft	Non-operative, all ages	104	58.6	15.3
	Ditto, under 15 - - -	50	86.0	8.0
	Operative, under 20 - - -	2	50.0	—
Lower extremity, involving knee	Non-operative, all ages	12	41.6	8.3
	Ditto, under 15 - - -	2	100.0	—
	Operative - - -	1	a moderate result only	—

A.S.A. REPORT, Table XII.

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
			per cent	per cent
Neck - - -	Non-operative - - -	63	15.8	7.9
	Operative - - -	6	33.3	None
Trochanter - - -	Non-operative - - -	8	37.5	12.5
	Operative - - -	4	25.0	None
Shaft - - -	Non-operative - - -	264	39.3	28.0
	Operative - - -	100	56.0	10.0
Condyles - - -	Non-operative - - -	4	25.0	50.0
	Operative - - -	4	25.0	None

AVERAGE DURATION OF INCAPACITY. (B.M.A. REPORT.)

Age	Site of Injury	Non-operative	Immediate operation
Under fifteen years	Upper epiphysis and neck	26.5 weeks	No record
	Shaft - - - - -	16.5 „	16.2 weeks
	Lower extremity - - -	18.2 „	No record
	Lower epiphysis - - -	— „	—
Over fifteen years	Upper epiphysis and neck	53.2 „	No record
	Shaft - - - - -	33.6 „	52 weeks
	Lower extremity - - -	18.7 „	26 „
	Lower epiphysis - - -	— „	—
Permanent* incapacity over 15 years	Upper epiphysis and neck	30 per cent	No record
	Shaft - - - - -	11.7 „	None
	Lower extremity - - -	25.0 „	None
	Lower epiphysis - - -	— „	—

* The table of permanent incapacity is made up from 252 non-operative cases, and a very small number of operative cases, useless for purposes of comparison.

A.S.A. REPORT, *Table XVI* (ALL CASES).

Site of Injury	Period of Incapacity
Neck - -	24.5 weeks
Shaft - -	24.3 „

If we consider the figures of other authorities, we find Scudder¹³ reporting on 16 cases of fracture of the neck of the femur treated by traction and immobilization. The cases were examined two and a half to twenty-four and a half years after the accident, at ages between forty-two and over sixty. Of the 16, 14 had impairment of function ; 2, that is, 12.5 per cent, gave good functional results. In Walker's¹⁴ report of 112 cases, 18 died within a week of admission to hospital, and 32 were not traced ; of the remaining 62, only 10 had completely recovered, that is, about 16 per cent of good functional results followed. Ashhurst and Newell¹⁵ give the end-results of 21 cases of fracture of the neck of the femur treated conservatively ; 5, or 23.8 per cent, had a perfect functional result.

From this we conclude that 26 per cent of good functional results is the best we can expect from non-operative treatment in adults. Willis C. Campbell reports¹⁶ on 116 cases of fractures of the neck of the femur ; 70 being fresh cases under the care of the writer, 46 ununited fractures months or years after injury. Ages from 9 to 88, the majority being above 60. Of the 70 fresh cases, 15 were trochanteric and united readily, 7 were impacted and gave an excellent result ; 7 below the trochanter gave 100 per cent firm bony union, 5 died (3 from uræmia, 1 pneumonia, 1 anæsthesia). Seven were too recent for consideration ; 29 were central, that is, fractures of the neck proper. These were treated by the Whitman abduction method, and 24 gave excellent functional results, that is, they were able to walk without pain, discomfort, or support ; 4 failed, 1 result unknown. A slight limp persisted in a majority, though a number walked perfectly. In two a gradual coxa vara developed ; in one there was eventual separation. Forty-four ununited fractures of the neck were observed. From the history, 14 treated by Black's extension ; 9 plaster casts ; 4 Hodgen's splint ; 9 sand-bags ; 2 osteopathy ; 1 ambulatory ; 5 no diagnosis—no treatment. Of the 44, 24 were operated on. In 2, edges freshened, 1 successful—1 failure. In 7, wire nail through trochanter neck and head ; result, 2 successful, 4 failed, 1 improved. In 15, tibial graft employed ; of these 11 were successful, 2 failed, 1 improved, 1 too recent to form an opinion. Grafts were not used where marked atrophy of head was present. No death following operation, but these were selected cases. The writer is a believer in the plaster cast from the nipple line to the toes, and in some instances the opposite limb to the knee. He thinks that the mortality is less with the cast than any other method, that is, if the condition of the patient will permit any kind of treatment.

Henderson¹⁷ records 33 cases of ununited fracture of the hip treated by operation. The results were disappointing—7 successes and 26 failures. He prefers a bone-graft, preferably the fibula.

Scudder's¹³ statistics of 35 cases of fracture of the shaft of the femur treated non-operatively by Buck's extension, outside T splint, or long Desault apparatus and later plaster, show that of 16 cases between eighteen and forty-eight years, 5 had a perfect result ; in 5 cases in which the average age was fifty-eight years, none had a functionally perfect result. Of 14 cases where the average age was seven and a half years, all had functionally perfect results ; four mention slight pain occasionally, and these have a little stiffness of the knee.

This gives a good functional result in about 24 per cent over eighteen years.

Lambotte's report shows 13 cases of immediate operation for fractures of the femur : 10 had a good anatomical and a good functional result, 2 a good anatomical and moderate or bad functional result. That is to say, a good functional result is achieved in 76.9 per cent of cases operated on.

Walker¹⁸ records 21 cases of operation for fractured femur ; operation was only performed after the best efforts of conservative treatment had failed. The Lane technique

was carried out, with Semon extension and plaster case. No mortality or serious complication followed; in one case the plate was removed for slight superficial suppuration. Improvement has resulted in every instance.

Patella.—The prognosis in stellate and longitudinal or subaponeurotic fractures is usually good under early massage and movement treatment. Transverse fractures with separation or the interposition of aponeurotic tags between the fragments have a more serious outlook as regards restoration to full function.

Helferich¹⁹ (1899) quotes Bahr's report on 44 old cases averaging four years after the injury. In 42 some weakness remained, amounting to 35 per cent of working power; this is 4·5 per cent good results.

Bull's²⁰ report (1890) is a vast improvement; 16 cases are recorded; he states that 14 of these, or 87·5 per cent, had 'excellent' results. They were all treated by plaster-of-Paris splints, with appropriate confinement of the fragments.

Lucas-Championnière, who applied his method of massage and mobilization to most fractures, held that the treatment is only of exceptional application in fractures of the patella; as a general rule, suture was his method of choice, for the reason that it brings about a definite anatomical restoration.

Power's²¹ (1898) collection of 711 cases operated on, exhibits a mortality of 1·4 per cent. The late results showed 94 per cent of satisfactory results, 3 per cent had marked stiffness and disability, 1 per cent had total ankylosis.

Stimson²² (1910) records 200 operative cases in two series. First series (40 cases): 2 became infected, with resulting stiffness. Second series: all recovered without accident, with good use of joint; these show 99 per cent good results.

Lockwood²³ (1911) reports 39 operations on 38 patients, ages twenty-two to sixty-three. The wires had to be taken out in 2 cases; skiagrams were available in 12, and of these, 11, or 91·6 per cent, had good bony union and good limbs. He is strongly in favour of operation, as it gives better results in a shorter time.

Delatour²⁴ (1914) gives an account of 99 operations: of these, 6 patients have useful joints, but with limited motion; 40 have flexion to at least a right angle, and perfectly useful joints. The remainder were not traced; all had good motion to at least forty-five degrees when they left hospital, and a satisfactory result was expected.

Scudder¹³ (1915) quotes a report by Quinby on 30 cases; of these, 24 were treated by suture and 6 expectantly. Serviceable results were obtained in 84·5 per cent of the operative cases and 66·5 per cent of the expectant. He notes that certain troubles follow either form of treatment, and that the operative treatment is to be preferred in selected cases.

There can be no doubt that in transverse fractures with separation, operation, apart from the definite though small risk of sepsis, will give the only chance of bony union, and so contribute materially to a good functional result. Under operative treatment the period of incapacity will be from two to three months; under conservative treatment from six to twelve months.

Constitutional disease or age may decisively influence the selection of conservative methods.

Re-fracture.—Corner's²⁵ paper puts this matter very clearly. After stating that the patella is the most frequently re-fractured bone in the body, he points out that this occurs most often between the ages of thirty and forty. After operation, 69 per cent of re-fractures occur in the first year; after non-operative treatment, 86 per cent of re-fractures occur after the first year.

The percentage of re-fractures is approximately the same after operative as after non-operative treatment.

Tibia and Fibula.—Lambotte's figures for immediate operative cases of fractured tibia show 5 cases, with 4 good anatomical and good functional results, and 1 moderate or bad anatomical and good functional result; that is, 100 per cent of good functional results after operation.

Lambotte's statistics of 18 cases of fracture of both bones show good functional results by operation in 95 per cent. Of 35 cases operated on for failure to maintain apposition, non-union, or defective or faulty union, 8 had a good anatomical and 21 had a good functional result; that is, a percentage of 60 good functional results.

FRACTURES

RESULTS OF NON-OPERATIVE AND IMMEDIATE OPERATIVE TREATMENT OF FRACTURES. (B.M.A. REPORT.)

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
			per cent	per cent
Shaft of tibia	Non-operative, all ages	424	74.4	10.7
	Ditto, under 15 - -	223	95.0	2.0
	Operative - - -	17	76.4	17.6
	Ditto, under 15 - -	7	100.0	—
Shaft of fibula	Non-operative, all ages	152	70.5	3.9
	Operative - - -	2	100.0	—
Both bones	Non-operative, all ages	548	44.4	25.6
	Ditto, under 15 - -	116	94.0	—
	Operative, all ages -	22	63.6	4.5
	Ditto, under 15 - -	2	100.0	—
Pott's fracture	Non-operative, all ages	246	37.5	10.4
	Ditto, under 15 - -	8	87.5	12.5
	Operative, all ages -	4	50.0	—

A.S.A. REPORT, Table XIII.

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
			per cent	per cent
Shafts (also shaft of tibia alone, 24 cases)	Non-operative -	73	46.5	16.4
	Operative -	19	68.4	—
Ankle : all forms	Non-operative -	44	56.8	4.5
	Operative -	0	—	—

AVERAGE DURATION OF INCAPACITY. (B.M.A. REPORT.)*

Age	Site of Injury	Non-operative	Immediate operation
Under fifteen years	Shafts - - -	12.8 weeks	9 weeks
	Lower epiphysis, Pott's fracture - - -	22 „	No record
Over fifteen years	Shafts - - -	26.7 „	31.2 weeks
	Lower epiphysis, Pott's fracture - - -	23.7 „	14.5 „
Permanent incapacity over 15 years	Shafts - - -	8.1 per cent	9 per cent
	Lower epiphysis and Pott's fracture - -	6.0 „	25 per cent bad results

* The non-operative cases number in all 797, and the immediate operative only 26, so the value of the table lies in the non-operative side.

A.S.A. REPORT, Table XVI (ALL CASES).

Site of Injury	Period of incapacity
Shafts - - -	17 weeks
Ankle - - -	17 „

In Bardenheuer's account of 149 cases of ankle fractures generally, 77.2 per cent recovered before ninety-one days ; 20 had passed the fiftieth year ; half of these had fracture of both bones ; 19 of the 20 had become fit for work.

Bardenheuer points out that this good result in older people should be taken as proof of the excellence of his extension bandage.

Hitzrot²⁶ traced 64 non-operative cases of Pott's fracture one year after injury. Thirty-eight cases were under thirty-five years, and all had perfect functional results. Of 12 between thirty-five and fifty years, "function was perfect in all the cases, extension was normal, but there was distinct limitation of flexion in all". Of 14 between fifty-five and sixty-four years, "function was perfect in 4 only, 5 had practically a stiff joint. Flexion and extension were limited in all".

Chaput,²⁷ in a careful study of 30 cases of malleolar fractures treated non-operatively, notes only 7 good results (23.3 per cent), 4 fairly good, 9 moderate, and 10 bad.

Of 6 cases where operation was undertaken, after the failure of external mechanical methods, for non-union, or faulty or defective union, 1 had a good anatomical and 1 a good functional result, 3 had a bad anatomical, and 3 a bad functional result.

Roberts and Kelly²⁸ quote Haenel's statistics on fractures of the tibia and fibula at the ankle. There were 40 cases: 70 per cent recovered, 30 per cent became disabled; the average loss of ensuing efficiency was about 50 per cent.

Late Separation of the Epiphyses.—Aug. Broca and J. Murard⁵⁰ record 7 cases of young adults between twenty and twenty-four years; 1, separation of the lower epiphysis of the tibia with Dupuytren's fracture, a football accident; 6 cases, involving the inferior extremity of the radius, 3 by a fall, 3 by crank backlash.

Astragalus.—The table constructed by G. Gayet²⁹ gives the results of the operative treatment of fractures of the astragalus. If there is no displacement, or if displacement and the fragments are easily reduced and maintain their position, massage and early movements will in all probability give a good result.

If there is much displacement of fragments, partial or complete removal of the bone will be required.

Of 22 cases up to the age of sixty-four years in which complete removal of the bone was performed, 21 (95.9 per cent) gave a good result in the sense that the patient was able to return to his occupation; the bad result was in a case operated on eight months after the fracture. Of 10 cases of partial removal, 1 only (10 per cent) gave an excellent result, 1 a satisfactory result, and 1 returned to work but was quickly fatigued.

Cabot and Binney³⁰ give figures in respect of 8 cases. There was a good result in 25 per cent and a bad result in 75 per cent, and they conclude that the results are distinctly worse than in fracture of the calcaneum. The average period of disability was about a year and a half. In making a prognosis from an *x-ray* photograph in cases of fracture of the astragalus, it is well to remember that the posterior surface of this bone has a small tubercle, the *os trigonum*, which occasionally has a separate existence and so simulates a fracture.

E. Villard and E. Perrin³¹ report on astragalectomy in the treatment of consolidated mal-union fracture of the malleolar region, astragalus, and deformities in connection with lesions of the soft parts. The results are stated to be excellent in 88 per cent of cases; the best results being in cases of pure fractures of the astragalus.

Calcaneum.—Three forms of this fracture are recognized: (1) *Of the posterior portion with the tendo Achillis*; (2) *Comminution of the body*; (3) *Of the sustentaculum tali*.

In the first form there is not usually much separation of the fragments; but if there is, then operation and fixation by a screw will give the best results. In the second form, accurate anatomical reposition is not generally feasible; operation may be required to remove fragments; in any case the results are very unsatisfactory. In the third form, there generally results a certain amount of eversion and sinking of the inner border of the foot.

In all the forms there frequently follows pain in the foot and difficulty in walking; consolidation of the fracture itself is much delayed, and no weight should be borne on the foot for at least two months.

Ely³² records 12 cases of fracture of the calcaneum; in 1 only was the result good (8.6 per cent).

Cabot and Binney's³⁰ statistics of 26 cases show good results in 50 per cent, fair in 38 per cent, and bad in 12 per cent. These good results seem to be quite above the average, and appear to be accounted for by the fact that 7 were heel-fragment cases,

and that 5 of these had good, and 1 a fair result. The average duration of disability was about six months. This period appears short, probably on account of the number of heel-fragment cases in the series.

Cotton³³ reports on 83 cases. Only 5 had anything approaching a good result. He believes that he is obtaining better results by moulding the fragments and producing impaction by hammering.

Cuboid.—Fracture of this bone is rare, and there is not generally great displacement of fragments, though the fracture is usually a comminuted one. A good result may be expected.

Tarsal Scaphoid.—Isolated fracture of this bone is not very rare, and a considerable number of cases have been reported. It is difficult to maintain the fragments if much displaced, or even to reduce them; but if this can be effected, then a good result will probably follow. In cases where the fragments cannot be reduced, removal by operation is indicated.

Macausland and Wood³⁴ report 2 cases of between five and six months' standing of complete removal of the scaphoid for fracture, with a good functional result in both.

Abadie and Raugé³⁵ report 28 cases; of the 15 in which the result is mentioned, 4 were operated on, and 3 of these had a good result; 11 were treated non-operatively, and 3 had a good, 4 a moderate, and 4 a bad result. The tubercle of the scaphoid is occasionally fractured by muscular action, such as dancing, and a valgus condition may ensue. In forming an opinion from a radiograph, it is well not to overlook the occasional presence of a sesamoid bone in the tibialis posticus tendon; it might be taken for a fracture of the scaphoid tubercle.

Cuneiform Bones.—Fractures of these bones occur in association with a crush of the foot, and the prognosis depends largely on the damage to other parts. If a readjustment can be made and the soft parts recover, then a fair result may be expected.

Metatarsals.—Fractures of these bones may cause considerable disability in the use of the foot if a fair alinement of the bones cannot be achieved. If there is much displacement of the fragments, anatomical restoration and fixation by operation will give good results. Fractures united with marked upward or downward displacement frequently cause very definite disability.

Fifth Metatarsal (Jones's fracture).—An indirect fracture which occurs by inversion, treading on the outer side of the foot; the line of fracture is near the base. There is neither crepitus nor deformity. The diagnosis depends on the radiographs, and the prognosis is good.

Phalanges.—These fractures are frequently compound, and the prognosis depends largely on whether the wound infection is localized, or becomes extensive, involving joints and tendon sheaths. In the former the result will be good, and in the latter great disability will ensue.

Humerus.—It will be observed from the table appended that the results of fractured tuberosity are not good, and it seems reasonable to expect better in cases in which the fragment is separate if it is fixed into position by means of a screw.

Seven cases of fracture of the surgical neck, 2 being under ten years, were treated by operation after failure of non-operative methods, owing to faulty or defective union. In all, the results were good; that is, 100 per cent good functional results. The operative results seem to be specially good for cases of this class.

In 13 cases of fracture of the shaft in which operation was undertaken on account of failure of non-operative methods, owing to faulty or defective union, 61.5 per cent had good functional results.

In 6 cases of supracondylar fracture, 2 being under ten years, in which operation was undertaken for failure of non-operative methods, owing to faulty or defective union, 33.3 per cent had good functional results.

Six cases of separated lower epiphysis were operated on for the same reason; 1, or 16.6 per cent, had a good functional result.

In a case of fracture of the internal condyle in which operation was undertaken for failure of non-operative methods, the functional result was only moderate.

Musculospiral Paralysis occurs in from 4 to 8 per cent of cases of fractures of the humerus, being associated most frequently with fracture in the middle third of the shaft.

**RESULTS OF NON-OPERATIVE AND IMMEDIATE OPERATIVE TREATMENT
OF FRACTURES. (B.M.A. REPORT.)**

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
			per cent	per cent
Anatomical neck	Non-operative - - -	5	80.0	—
	Operative - - - -	2	100.0	—
Upper epiphysis	Non-operative, under 20	5	80.0	20.0
	Operative, under 20 -	2	100.0	—
Tuberosity -	Non-operative - - -	3	33.0	—
	Non-operative, all ages	37	40.0	17.5
Surgical neck	Ditto, under 20 - -	10	100.0	—
	Operative, all ages -	6	60.0	—
	Ditto, under 20 - -	2	100.0	—
	Non-operative, all ages	68	64.5	21.9
Shaft - - -	Ditto, under 15 - -	18	61.0	22.0
	Operative, all ages -	6	83.3	—
	Non-operative, all ages	17	41.1	11.1
Supracondylar	Ditto, under 15 - -	8	75.0	12.5
	Operative, under 15 -	1	100.0	—
Lower epiphysis	Non-operative - - -	50	44.0	22.0
	Operative - - - -	14	57.1	7.1
Internal condyle	Non-operative, all ages	17	41.1	23.5
	Ditto, under 15 - -	11	72.7	—
External condyle	Non-operative, under 25	7	14.2	42.8

A.S.A. REPORT, Table X.

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
			per cent	per cent
Shoulder - {	Non-operative - - -	15	60.0	20.0
	Operative - - - -	15	40.0	6.6
Shaft - - {	Non-operative - - -	19	47.3	36.8
	Operative - - - -	8	12.5	None
Elbow - - {	Non-operative - - -	56	76.7	16.0
	Operative - - - -	13	53.8	None

The prognosis is fairly good after suture, or release, or both. Scudder and Paul's³⁶ table of 11 cases treated by operation shows 8 cases of recovery of function—72.2 per cent—the shortest interval in the successful cases between the accident and the operation being three weeks, and the longest three years. The statement of Bruns, that 50 per cent of all cases require operation, seems to be worth noting.

Hitzrot's²⁶ statistics refer to 141 non-operative cases of fracture of the surgical neck of the humerus. Two were in children, 1 treated by non-operative and the other by operative methods; both had perfect results. In the remaining 139 cases, hyperabduction to the amount of 5 per cent was lost in all except 2; external rotation to the amount of 5 to 10 per cent less than normal was present in all cases.

The treatment adopted was: Arm flexed and held in a sling, cushion in axilla, extension of from 5 to 10 lb. applied and allowed to hang for an hour. When fracture is reduced, shoulder plaster splints back and front down to wrist; x-ray control, splints on for three to five weeks, massage and movements at end of ten days, galvanic and faradic currents to deltoid.

Scudder,¹³ on the indications for and results of excision of the shoulder-joint for fracture and dislocation, observes that this is not a complete excision, but merely partial—that is, removal of the head of the humerus. He states that he is much impressed by the disability which follows this operation. The operative mortality is nil, but 59 per cent of the patients had only fair results. This is striking when contrasted with a number of unreduced dislocations and fractures with surprisingly good function.

Lower End of Humerus.—There were 106 cases, all under ten years: 51 cases of fracture of the external condyle in children treated by hyperflexion for two weeks, then massage; in 1, a fragment had to be removed; all had perfect return of function; 54 cases of supracondylar fracture in children reduced under anaesthesia, arm flexed at right angle or beyond; two cases had musculospiral paralysis and were operated on, function becoming complete in twenty weeks in one case, in the other, not so satisfactory, in thirty-six weeks.

Of these cases, 50 had no perceptible deformity; function of the elbow-joint was perfect in all cases. In 34 adult cases, 12 involved the external condyle; 11 were uncomplicated; all treated by as much hyperflexion as possible; no deformity resulted; function excellent, but not perfect. Six cases of fracture of the internal condyle were treated by reduction under ether and flexion; function excellent in all, perfect in one.

Fractures of the Elbow.—André Trèves³⁷ gives a careful account of the late results of 162 cases in children, as follows:—

Site of Injury	Under 5 years	5-10 years	10-15 years	Results
Supracondylic -	18	51	10	Perfect function in 88 per cent
External condyle	17	21	4	Excellent function 80 per cent
Simple internal condyle -	1	16	17	Perfect function 61 per cent
T fracture -	0	1	1	Satisfactory 50 per cent
Lower epiphysis	3	2	0	Perfect function 100 per cent

Ten supracondylic cases had operations for defective union, and 6 for nerve injuries. Six internal condyle cases had operations for defective union, and 3 for nerve injuries: Thirteen fractures of the internal condyle with luxation had 10 perfect results—77 per cent.

These figures again show that good functional results are obtained in children by non-operative methods. Trèves says that the treatment, save in supracondylic by flexion, where extension is required, and the supracondylic with lateral displacement, where extension is admissible, should be by immobilization in flexion, the duration of immobilization being from eight to fifteen days, and not beyond three weeks. Early massage and movements are harmful, because they produce excessive callus in children, and besides, they are very painful.

Nerve lesions complicating fractures of lower end of the humerus are not often present; they rarely require operation. Roberts and Kelly²⁸ give statistics as follows: Ashhurst, 1 case of median-nerve injury in 56 cases; Coenen, 3 musculospiral injuries in 31 supracondylar fractures; Destot, Vignard, and Barlatier, 1 case of musculospiral and 1 case of median injury in 72 fractures above the elbow; Broca and Mouchet, 9 cases of nerve injury in 78 elbow fractures. Muller considers that nerve complications develop in 20 per cent of all supracondylar fractures.

Roberts and Kelly²⁸ give a table from Ashhurst recording the end-results of fractures of the lower end of the humerus:—

Author	No. of cases	Cases treated	Perfect results
Ashhurst - - - - -	56	47	per cent 81.0
Coenen - - - - -	31	28	25.0
Cotton - - - - -	31	27	18.5
Destot, Vignard, and Barlatier -	—	39	28.2
Hilgenreiner - - - - -	21	14	21.3

This table gives an average of about 40 per cent ‘perfect results’.

It is advisable to inform parents and patients that an inconcinuous or inelegant joint does not necessarily mean that there will eventually be great functional incapacity.

AVERAGE DURATION OF INCAPACITY. (B.M.A. REPORT.)*

Age	Site of Injury	Non-operative	Immediate operation
Under fifteen years	Anatomical neck and upper epiphysis - - -	8 weeks	No record
	Surgical neck and shaft -	10.5 "	26.0 weeks
	Lower epiphysis and supra-condylic - - -	13.5 "	8.7 "
Over fifteen years	Anatomical neck and upper epiphysis - - -	5.2 "	8.0 "
	Surgical neck and shaft -	27.6 "	32.8 "
	Lower epiphysis and supra-condylic - - -	17.1 "	78.0 "
Permanent incapacity over fifteen years	Anatomical neck and upper epiphysis - - -	20 per cent	None
	Surgical neck and shaft -	10 "	8% bad results
	Lower epiphysis and supra-condylic - - -	17 "	6% " "

* The table deals with 92 non-operative cases and 11 operative cases, and, for what it is worth, shows operative treatment in a favourable light ; but the operation cases are too few to base a reliable opinion upon.

A.S.A. REPORT, Table XVI (ALL CASES).

Site of Injury	Period
Shoulder - - -	10.9 weeks
Shaft - - -	12.0 "
Elbow - - -	8.2 "

Radius and Ulna.—

RESULTS OF NON-OPERATIVE AND IMMEDIATE OPERATIVE TREATMENT OF FRACTURES OF RADIUS AND ULNA. (B.M.A. REPORT.)

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
			per cent	per cent
Radius, upper epiphysis	Non-operative, under 15	2	50.0	—
	Non-operative, all ages -	45	53.1	12.7
Radius, shaft	Ditto, under 15 - - -	19	73.6	10.5
	Operative, all ages - - -	7	57.1	14.2
Radius, lower epiphysis	Ditto, under 15 - - -	4	75.0	25.0
	Non-operative, all ages -	15	66.6	13.3
Colles's - - -	Ditto, under 15 - - -	11	63.6	9.0
	Operative, under 10 - - -	1	100.0	—
Ulna, olecranon	Non-operative, all ages -	47	27.6	29.7
	Ditto, under 15 - - -	4	100.0	—
Ulna, shaft -	Operative - - -	1	100.0	—
	Non-operative, all ages -	20	45.0	30.0
Ulna, lower epiphysis	Operative, all ages - - -	19	73.6	5.2
	Non-operative, all ages -	18	77.7	11.1
Radius and ulna	Ditto, under 15 - - -	10	80.0	10.0
	Operative - - -	1	result	not good
Radius and ulna	Non-operative - - -	3	100.0	—
	Non-operative, all ages -	2	38.0	17.1
Radius and ulna	Ditto, under 15 - - -	76	63.0	—
	Operative, all ages - - -	54	75.0	—
Radius and ulna	Ditto, under 15 - - -	3	100.0	—

FRACTURES

A.S.A. REPORT, Table XI.

Site of Injury	Treatment	Cases	Good anatomical and functional	Poor anatomical, good functional
Shaft	Non-operative	53	per cent 60.3	per cent 30.18
	Operative	24	70.8	None
Wrist	Non-operative	12	50.0	25.0
	Operative	3	66.6	None

Hitzrot²⁶ records 15 cases of fracture of the head of the radius with little displacement ; flexion and extension eventually were complete in all, but in 11 cases pronation and supination were only half the normal. Of 4 cases with displacement of fragments, in 2 the head had to be removed in its entirety ; in the remaining 2 a broken fragment only was removed. The functional result was best in the cases in which the head was completely removed, and not good in the 2 cases of partial removal.

In 10 cases of fracture of the neck of the radius of the transverse type half an inch below the head, 2 (20 per cent) had a good and 8 a moderate functional result.

If the head of the radius is removed, leaving the orbicular ligament undamaged, then good functional results may be expected with some assurance.

Arrest of growth of the radius is to be found as an end-result of separation of, or injury to, the lower radial epiphysis.

Poland³⁸ records 17 out of a total of over 700 of these cases. He also notes 56 cases of arrest of growth after these injuries, the radial cases being the most numerous. Recently, 3 cases have come under my own observation ; the diminished length of the radius, and the normal length of the ulna, gave the hand its characteristic deformity. In only 1 of these 3 was the functional result good.

Table VII of the B.M.A. Report gives a summary of all fractures over fifteen years, and notes the average duration of incapacity :—

Duration of incapacity	Percentage of cases of permanent incapacity
Non-operative 27.6 weeks	9.0 per cent
Operative 27.3 „	7.8 „

AVERAGE DURATION OF INCAPACITY. (B.M.A. REPORT.)*

Age	Site of Injury	Non-operative	Immediate operation
Under fifteen years	Radius and ulna - - -	17.1 weeks	6 weeks
	Colles's fracture - - -	3.7 „	No record
Over fifteen years	Radius and ulna - - -	20.6 „	19.4 weeks
	Colles's fracture - - -	17.1 „	—
Permanent incapacity over fifteen years	Radius and ulna (including lower epiphysis) - - -	6.0 per cent	8 per cent
	Colles's fracture - - -	14.7 „	—

* The non-operative cases include 64 radius and ulna fractures and 34 Colles's, and the operative cases 25 radius and ulna and only 1 Colles's fracture.

A.S.A. REPORT, Table XVI (ALL CASES).

Site of Injury	Period
Shafts -	10.3 weeks

Carpal Scaphoid.—Hitzrot²⁶ records 14 cases, 7 without displacement of fragments, treated by a moulded anterior splint, fingers free, hand in slight radial deflection and extension, early massage, full movement in sixth week. The result was that hyper-extension was limited in all, flexion in 1, with pain on movement. In 3 cases with displacement of proximal fragment, the latter was removed by dorsal incision and treated as the foregoing; result, extension two-thirds normal, flexion seven-eighths normal, deflection less than normal. There were 4 cases with similar displacement associated with dislocation of the semilunar; the fragment and the semilunar were removed in 3; the result was fair. In the fourth case the fragment of the scaphoid was removed, and an ineffectual attempt to reduce the semilunar was made; the result at the end of nine weeks was a stiff wrist. The prognosis is not wholly good, though Cotton³⁹ says that in 3 of his cases in which removal of fragments was done in uncomplicated fractures, the results were practically perfect.

Lambotte⁴⁰ thinks that in view of the unsatisfactory results ordinarily obtained, the fragments could be readily held together by a fine screw, with a better result.

Campbell⁴¹ records 3 cases of fracture of the carpal scaphoid with a lesion of the median nerve, which eventually made a good recovery as regards the nerve injury. In examining a radiograph for this fracture, it is necessary to remember that in about 1 per cent of persons the scaphoid is normally divided into two parts in the course of development; this might be mistaken for a fracture.

Semilunar.—A number of cases of fracture of this bone have been recorded by Ebermayer,⁴² Finsterer,⁴³ and others. It is a compression fracture. The prognosis is not good as regards function; the bone may require removal on account of pain and diminished movements of the hand.

Os Magnum.—Fractures of this bone are relatively rare. Harrigan⁴⁴ has collected 6 authoritative cases, including one of his own; in 2 only was the diagnosis confirmed by *x* rays. The results do not seem to be satisfactory. In none of the cases is it stated that a good result ensued.

Trapezium, Trapezoid, Unciform, Pisiform.—Fractures of these bones have been reported. They are important, for they are likely to be followed by ankylosis, so that the best results may be expected from elastic pressure, early passive movements, and massage.

Metacarpals.—*Fracture of the First Metacarpal.*—This may occur at the distal end of the shaft or at the base. If good alinement can be achieved and maintained, a good result may be expected.

Fracture at the Base (Bennett's Fracture).—An oblique fracture through the base. Good anatomical reposition is not always achieved, but very fair functional results may follow.

Lambotte⁴⁰ has had a good result by fixing the fragment into position with a fine screw.

Separation of the Basal Epiphysis of the first metacarpal occasionally occurs. In the two cases recorded by Coues⁴⁵ a good result followed.

Fractures of the Shafts of the other metacarpals are apt to give serious trouble if a good alinement cannot be achieved; if this is obtained and maintained, the results are good. In difficult cases, oblique fractures and such like, Lambotte recommends a small form of fixateur, or a small plate, or cerclage, as giving good results.

Fractures of the Heads (knuckle fracture; pugilists' fracture).—According to Cotton,³⁹ some deformity always remains, flexion may be impaired, function generally is good. He quotes a case in which there were sixteen of these fractures in both right and left hands without serious loss of function occurring, except in one knuckle.

Phalanges.—These fractures usually unite well, and unless the crush, which is generally the cause, is severe, a good result follows moderate readjustment of the fragments.

Sesamoid Bones of the Thumb.—This fracture has been described by Preiser;⁴⁶ no bony union followed, but the functional result was good. Penn G. Skillern⁴⁷ collects 4 cases of these fractures, including the case of Preiser; 3 of them were due to direct violence, 1 was possibly due to indirect violence. He says that immobilization in a neutral position by a silicate of sodium dressing fulfils all indications.

Scapula.—*Fractures of the Body* are often multiple. Union takes place frequently

with overlapping or exuberant callus, but generally speaking good functional results ensue. Cotton states that in his 10 cases the results were practically perfect.

Acromion.—This fracture is rare. Union may be fibrous or bony; in either case the functional results are nearly always good.

Spine.—The edge may be broken, or the mass of bone, including the acromion, may be separated; some deformity, but no permanent disability, results.

Glenoid.—Fracture is rare, except as an accompaniment of dislocation of the head of the humerus. It is possible that chipping off of the edges may predispose to recurrence of the dislocation.

Coracoid.—The line of fracture is usually well behind the tip, but this may be split longitudinally. Union is seldom bony, but there is no displacement unless the coracoclavicular ligaments are torn. Rarely is there any great functional disability.

Neck.—The line of fracture is through the suprascapular notch to the axillary border. Bony union with some displacement is the rule. In the majority of cases good functional results ensue.

Sternum.—Fractures of this bone are usually associated with damage to the intrathoracic or abdominal organs, and the prognosis may depend on the extent of injury there. Gurlt collected 98 cases, and of these 54 were simple cases: 46 recovered, 8 died; whilst of 44 cases complicated by severe injuries, only 1 recovered.

Fracture of the Ensiform Cartilage may occur. It is sometimes followed by troublesome vomiting, which, in one of the 4 cases tabulated by Gurlt, persisted for two years and then ceased spontaneously. In three of the cases, vomiting ceased when the depressed cartilage was drawn forward.

Clavicle.—These fractures usually unite well; non-union is rare. The bond is firm at the end of four weeks. Displacement, deformity and shortening are the rule. The amount of shortening may be as much as two inches. These conditions, however, do not follow in those cases in which the line of fracture is transverse, and where displacement is absent at the beginning.

Despite deformity and shortening, the functional usefulness of the arm is seldom much interfered with.

The rare complications of this fracture, which render the prognosis not good, are injuries to the subclavian artery and vein, brachial plexus, or lung, and pressure by exuberant callus. If operation is required for great deformity and failure of the usual treatment to maintain a correct position, or for other reasons, a screw driven in longitudinally, or cerclage (Lambotte's), or a fine Lane plate away from the skin, will give good results.

Ribs.—Simple fractures without complications do very well. If excessive callus forms and persists, it may cause pressure on intercostal nerves, and persistent pain may follow. In old or feeble persons, the immediate outlook is more serious, pneumonia being the most dangerous sequela.

Costal Cartilages.—Fractures occur most frequently near the costochondral junction, the seventh and eighth being most often involved. The prognosis is good. Union takes place by means of osseous or fibro-osseous tissue.

Pelvis.—Fractures of the pelvis are not common, and the prognosis depends largely on the associated damage to pelvic viscera.

Shock is a cause of death in many cases. If the patient recovers, there is frequently deformity, which, if it obstructs the pelvic outlet in females, may be a serious matter during parturition. On the other hand, in the lesser injuries, the results may be quite good.

Paul⁴⁸ records a table of 54 cases, with a mortality of 50 per cent. Five laparotomies were done—four for ruptured bladder or rectum—and all died. Four external urethrotomies were required; two died.

Coccyx.—Fractures of this bone are frequently followed by much discomfort, sometimes by severe pain. Excision gives very excellent results.

Burnham⁴⁹ gives figures on the prognosis in respect of the various bones of the pelvis:—

Ilium.—Nine cases. In 1 laparotomy was necessary, in 1 radical repair of the fracture. Of the 9 cases, 8 are definitely recorded as cured, i.e., 88·8 per cent.

Pubis and Ischium.—Ten cases. In 6 there were urinary symptoms of varying degrees of severity. Most of them were complicated by other injuries. Death occurred in 1 case, 3 cases required operation, and 6, i.e., 60 per cent, were definitely cured.

Body of Os Pubis.—Two cases. No complications occurred. One case was definitely cured, i.e., 50 per cent.

Multiple Fractures of Pelvic Ring.—Five cases. There were urinary symptoms in 3, operation was performed in 2, there were 2 deaths, and 1 definite cure, i.e., 20 per cent.

Superior Maxilla.—In uncomplicated cases union takes place in about four weeks. Severe neuralgia may follow as a consequence of the superior maxillary nerve becoming involved in callus. Deformity is not common.

Malar Bone.—The prognosis is usually good. There is generally little callus formation. Reposition should be attempted early.

Nasal Bones.—The prognosis must be very guarded as to eventual deformity. The primary external disfigurement does not tend to become accentuated, but the internal obstruction, if any, does.

Mandible.—Simple fractures, in which the mucous membrane is not torn, unite in about six weeks; the prognosis is usually good. Even severe compound fractures terminate with remarkably good results. Non-union is very rare; statistics show that this occurs in only 2 per cent of all pseudo-arthroses noted. Fractures of the condyloid process may be followed by ankylosis of the temporomaxillary joint.

Hyoid Bone.—Fractures of this bone are extremely rare, owing to its elasticity and protected position. In Gurlt's collection of 27 cases, 21 were fractures of the bone alone. In simple uncomplicated fractures the prognosis is good. The serious complications are œdema of the larynx, necrosis, abscess, and hæmorrhage.

Larynx and Trachea.—The prognosis is very grave. Of 75 cases reported before 1879, the mortality was 78·6 per cent. Of 70 cases reported since that date, the mortality was 37 per cent. The dangerous complications are œdema of the larynx, intralaryngeal and intratracheal hæmorrhage, mediastinal emphysema, septicæmia, and aspiration pneumonia.

ESTIMATION OF DEPRECIATION OF CAPACITY FOR WORK.

BROUARDEL'S *Table I.*

Permanent Infirmities : 100 indicates the maximum of loss	Day labourers	Occupation specially requiring the use of the upper limbs	Occupation specially requiring the use of the lower limbs	Workers in the arts
RIGHT UPPER LIMB				
Loss of whole limb -	70-80	70-80	50-70	70-90
Loss of part below elbow -	70-80	70-80	50-60	70-90
Loss of hand -	60-75	65-75	45-55	70-90
Loss of thumb -	25-35	25-35	15-25	40-55
Loss of index finger -	10-15	10-25	10-15	25-35
Loss of middle finger -	10-15	10-15	5-10	15-25
Loss of ring finger -	5-10	5-10	5-10	15-20
Loss of little finger -	5-10	5-10	5-10	15-20
Complete ankylosis of shoulder	40-55	40-50	25-35	40-65
Incomplete ankylosis of shoulder according to degree -	10-40	10-40	10-25	30-40
Complete ankylosis of elbow -	30-40	30-35	10-25	35-45
Incomplete ankylosis of elbow according to degree -	10-30	10-30	0-10	20-35
Complete ankylosis of wrist -	20-35	20-30	5-15	30-45

On the Continent, in cases in which there is complete and permanent disablement, compensation is allowed equal to two-thirds of the wages earned. In the United Kingdom, half the average weekly wage is paid so long as there is incapacity for work. The worker will receive his full compensation, so long as he is unable to do any work.

FRACTURES

BROUARDEL'S Table II.

Permanent Infirmities : 100 indicates the maximum of loss	Day labourers	Occupation specially requiring the use of the upper limbs	Occupation specially requiring the use of the lower limbs	Workers in the arts
LEFT UPPER LIMB				
Loss of whole limb - -	60-70	60-70	40-50	70-80
Loss of part below elbow - -	60-70	60-70	40-50	70-80
Loss of hand - - - -	55-65	55-65	30-40	70-80
Loss of thumb - - - -	15-25	15-25	10-25	25-40
Loss of index finger - - -	5-15	5-15	5-15	15-25
Loss of middle finger - - -	5-10	5-10	5-10	15-20
Loss of ring finger - - -	5-10	5-10	0-5	10-15
Loss of little finger - - -	0-10	0-5	0-5	5-10
Complete ankylosis of shoulder	40-50	30-45	10-25	35-55
Incomplete ankylosis of shoulder				
according to degree - -	10-40	10-30	0-10	10-35
Complete ankylosis of elbow -	25-35	25-35	5-15	25-40
Incomplete ankylosis of elbow				
according to degree - -	5-25	5-25	0-5	10-25
Complete ankylosis of wrist -	15-20	15-20	5-10	20-30
Incomplete ankylosis of wrist				
according to degree - -	5-15	5-15	0-5	5-20

BROUARDEL'S Table III.

Permanent Infirmities : 100 indicates the maximum of loss	Day labourers	Occupation specially requiring the use of the upper limbs	Occupation specially requiring the use of the lower limbs	Workers in the arts
LOWER LIMBS				
Loss of whole limb - - -	50-75	50-75	70-90	50-75
Loss of limb below knee - -	50-70	50-70	60-80	50-70
Loss of foot - - - -	40-60	40-60	60-80	50-60
Loss of all the toes - - -	25-35	20-30	40-60	25-35
Loss of great toe - - - -	15-20	10-20	20-40	15-20
Great shortening of the lower limb (above 5 cm.) - - -	25-35	20-30	45-60	25-35
Slight shortening of the lower limb (below 5 cm.) - - -	up to 25	up to 20	up to 45	up to 25
Complete ankylosis of hip -	30-45	30-45	60-80	30-35
Incomplete ankylosis of hip				
according to degree - -	10-30	10-30	40-60	10-30
Complete ankylosis of knee -	20-30	20-30	40-60	20-30
Incomplete ankylosis of knee				
according to degree - -	10-20	10-20	30-40	10-20
Complete ankylosis of ankle -	10-25	10-25	40-60	10-25
Incomplete ankylosis of ankle				
according to degree - -	0-10	0-10	30-40	0-10

The preceding tables are after Brouardel,⁵¹ 100 being reckoned as the full estimation of depreciation. This figure is applied to such cases as complete loss of vision or loss of the use of two limbs. The tables will give a general idea of the depreciation in working capacity in the various permanent injuries, four types of workers being selected. The short notes which follow are intended to give a general idea as to the working capacity after injury of men who follow arduous occupations. The figures are taken from Brouardel, Rohmer,⁵² Ollive et Le Meignen,⁵³ and others.

Fractures at the Upper End of the Femur which result in non-union or excessive callus formation with interference with the movements of the joint, and ankylosis, may seriously depreciate a workman's earning capacity. He may be compelled to use a

stick, or even a crutch, and he will in all probability be obliged to seek other employment if his usual work required the full use of his hip-joint, as would be the case if the work involved climbing ladders, etc. Wasting of muscles is a frequent accompaniment of partial ankylosis, and adds to the incapacity. Complete ankylosis of the hip may be estimated at as much as 80 or even 90 per cent; at an angle, 58 per cent; atrophy of muscle, 33 per cent. If fixed in the flexed position, walking and standing will be interfered with; and if the fixation is in the extended position, there may be a difficulty in sitting. It will probably take at least eight months before the patient is fit to begin work in an ordinary simple case of fracture of the neck; this is presuming that the patient is not beyond middle age, and that there are no complications, such as arthritis, phlebitis, pseudarthrosis, etc.

Fractures of the Shaft of the Femur may be followed by non-union and almost complete incapacity for work. Union with shortening and deformity is more common. In measuring the shortening it is well not to forget that there is sometimes a difference in the length of normal lower limbs. Some authorities state that this is as much as 1 cm., and the increase is generally in favour of the left limb, so that a shortening to this extent may be considered of no importance. Ollive and Le Meignen are of opinion that shortening below 3 cm. should not be compensated unless it is associated with other lesions. Brouardel reckons great shortening to be that above 5 cm., and values it up to 60 per cent. In the lesser degrees of shortening, a great amount of accommodation occurs, and this can be easily assisted by adding to the thickness of the sole of the boot. In the greater degrees, correction is difficult and the incapacity for work is considerable, save in those workers who can sit at their occupation. The foregoing remarks on shortening apply equally to fractures of the tibia and fibula.

Angular deformity and excessive callus formation may prevent the full action of muscles. Pain will follow the involvement of nerves in callus, and it is frequently a cause of incapacity in cases of union with overlapping or bowing of the limb; standing for a length of time is sometimes impossible. If good alinement of the fragments is achieved, recovery will take place in four to six months; in many cases it will be as much as twelve.

Fractures involving the Knee-joint are sometimes followed by more or less ankylosis or weakness in the joint. If the ankylosis is in the straight position, the incapacity is about 40 per cent; in the flexed position, according to degree, up to 50 per cent; relaxed knee-joint, 58 per cent. The insecurity here is most noticed in going up or down ladders or stairs. Marked wasting of the muscles of the thigh frequently follows injuries to the knee-joint. In simple cases it generally takes from six to twelve months for full working capacity to be restored.

Fractures of the Patella.—If bony union is achieved, the return to full function is the usual course. If the union is fibrous and there is not much separation of fragments, a useful, though not perfect, limb results. If there is much separation of fragments, a weak and flail-like limb will result, with consequent incapacity, which may be as much as 50 per cent.

Fractures of the Shafts of Tibia and Fibula, united with deformity or with painful callus, are often associated with thrombosis, swelling of the limb, and trophic troubles. If non-union occurs, the incapacity is great. If the fracture is in the upper end, involving the knee-joint, the resulting condition may approximate to that found in fractures of the femur involving the knee-joint (q.v.).

If the Fibula is fractured near the upper end, the peroneal nerve may be involved either in the fracture or in the resulting callus, and a condition of talipes equinovarus ensue, with incapacity for work. (For shortening, see 'Fracture of Femur'.) In favourable cases a worker is usually fit to return to work in three or four months.

Fractures of the Lower End of the Tibia and Fibula involving the Ankle-joint are grave injuries, and very frequently result in serious incapacity. Deformity, a varying degree of ankylosis, and pain are the most frequent sequelæ. If the foot is fixed at a right angle—the most favourable position—the incapacity may be from 15 to 20 per cent, according to the nature of the work. If fixed at an acute angle, or in an extended position, the incapacity may be as much as 60 per cent. The older the patient, the less is the chance of his being able to return to full work.

The opinion of the late Mr. Clinton Dent, mentioned earlier, having reference to that picked body the Metropolitan Police, shows how very serious these injuries are in persons whose occupation requires long standing or walking.

Fractures involving the Tarsus and Metatarsus may sometimes cause permanent incapacity, occasionally equal to loss of the foot, on account of pain, swelling, and difficulty in walking or standing for a long time. Flat-foot may ensue, and is estimated at from 30 to 50 per cent. Sometimes the strain on the sound foot occasioned by the weight of the body being thrown on it in an effort to save the injured foot, causes a condition of flat-foot in a previously healthy foot.

In metatarsal fractures, if there is much displacement of the fragments either in an upward or downward direction, the pressure of the workman's hard boot may cause definite incapacity; metatarsalgia may ensue.

Fractures of the Toes rarely cause incapacity unless they become compound and septic. The loss of the great toe is estimated at from 10 to 20 per cent. The loss of a single phalanx does not cause any incapacity unless the scars are tender. The loss of several toes or all the toes may be estimated at from 20 to 30 per cent as a maximum.

In many tarsal fractures it will be six to eight months before the patient is fit to undertake heavy work, or in metatarsal fractures three to six months.

Fractures about the Upper End of the Humerus may be followed by more or less ankylosis and a consequent limitation of movement, atrophy of muscles, injury to the circumflex nerve, or chronic arthritis. Ankylosis may be estimated according to degree at from 50 to 60 per cent; atrophy of muscles 28 to 58 per cent; chronic arthritis 16 to 66 per cent. Arthritis may greatly delay recovery. Benign cases are well usually in two to four months, but severe ones may last as much as twelve months or more.

Fractures of the Shaft of the Humerus may be followed by non-union (which is relatively frequent), faulty position, pain, and involvement of the musculospiral nerve in callus. Any of these may cause almost complete incapacity. In uncomplicated cases recovery is usually complete in three to four months. Non-union occurs with greater frequency after fracture of the shaft of the humerus than after that of any other bone, 376 in 1274 cases of non-union in all bones. According to Bruns, only 56 per cent of recoveries follow resection; in 187 cases of pseudo-arthritis of the humerus so treated, 98 recovered, 3 were improved, 73 were unimproved, 5 died.

Fractures at the Lower End of the Humerus and Elbow-joint may be followed by complete or incomplete ankylosis, or loss of movements of pronation and supination. Ankylosis in extension may be estimated at from 40 to 50 per cent; in medium flexion, 33 to 40 per cent; in acute flexion, 20 to 25 per cent. Loss of pronation and supination may be a serious disability, especially in skilled workers, mechanics, etc. Simple uncomplicated cases frequently recover full working capacity in three months.

Fractures of the Radius and Ulna are sometimes followed by disability due to non-union or faulty union. In non-union the forearm is practically useless, and in faulty union there is frequently loss of pronation and supination.

Fractures at the Lower End of the Radius and Ulna involving the Wrist-joint are sometimes followed by more or less ankylosis. Complete ankylosis of the wrist is estimated at from 25 to 33 per cent. Partial ankylosis may not interfere with working capacity except in specially skilled trades. In favourable cases, probably about three months may be reckoned as the period of recovery.

Fractures of the Carpus may cause ankylosis similar to that which follows fractures in the wrist-joint. Simple cases recover in from one to three months; the shorter period will apply to those cases in which movements can be begun early.

Fractures of the Metacarpus are not usually followed by any very great incapacity unless the bones are united with great displacement.

Fractures of the Phalanges do not generally cause much disability. If the finger is ankylosed in a straight or flexed position, there will be interference with the full power of the hand, and amputation may be necessary to restore function. Loss of the thumb is the most important, as the hand is a forceps as well as a grasping instrument. If loss of a hand be reckoned at from 50 to 75 per cent, loss of the thumb will be equal to about one-third of this. Ankylosis of thumb-joints, 25 to 33 per cent; loss of a single phalanx of the thumb is a serious matter. Loss of index finger, 16 to 25 per cent. Ankylosis

of index joints, 8 to 25 per cent ; loss of one or more phalanges of the index will equal one- to two-thirds of the total loss of the index. The estimation of the loss of the middle finger is about 8 to 16 per cent, and the loss of the ring finger is a little less. The loss of the little finger is valued just under the last two mentioned.

Fractures of the Scapula.—If union is in a faulty position, so as to interfere with the movements of the shoulder or render these painful, the valuation of the incapacity is estimated at from 10 to 30 per cent. Most lesions about the shoulder are followed by an amount of wasting of muscle which frequently takes quite a long time to recover.

Fractures of the Sternum.—In simple uncomplicated fractures the prognosis is usually good, though pain is sometimes persistent, but rarely wholly incapacitating. If the ensiform cartilage is driven inwards, an operation may be required to raise it. Rémy⁵⁴ suggests 10 to 20 per cent valuation for a sinking in of the sternum without deep lesions.

Fractures of the Clavicle usually result in some deformity ; but if uncomplicated by injury to adjacent parts, there is in most cases an excellent recovery. Non-union is rare, but if it occurs an operation will be necessary. Excessive callus formation may cause pressure symptoms, pain, and incapacity for work. The estimation for imperfect recovery is from 16 to 50 per cent. In an ordinary case, about two months will elapse before full work can be undertaken. In severe cases it may be much longer.

Fractures of the Ribs.—Uncomplicated fractures usually heal well, and there is generally very little incapacity for work afterwards. Sometimes faulty union and excessive callus formation may leave painful neuralgia as a result. If incapacity occurs on raising the arm, or is due to pain, it may be reckoned at from 20 to 50 per cent, or even more. Austrian statistics, in a record of 1415 cases of fractured ribs, show 806 complete recoveries in periods up to seven months.

Fractures of the Pelvis.—Fractures of the pelvis are frequently complicated with fatal internal injuries. If recovery takes place, pain may be persistent, or it may be elicited by movements, and as a consequence walking may be difficult. Simple fractures of the ilium may unite with deformity causing very little incapacity.

Fractures of the Sacrum may result in great incapacity, particularly if nerves are involved.

COMPOUND FRACTURES.

An interesting table in the A.S.A. Report is the one numbered XXXII, giving comparative results of operative and non-operative cases of compound fractures. As statistics on these fractures are not readily found, the schedule set out is significant, though the number of cases is disappointingly meagre.

Site of Injury	OPERATIVE			NON-OPERATIVE		
	Cases	Good anatomical	Good functional	Cases	Good anatomical	Good functional
		per cent	per cent		per cent	per cent
Humerus (shaft) -	6	83	100	4	100	100
Radius (shaft) -	2	100	100	1	100	100
Ulna (shaft) -	1	100	100	2	100	100
Radius and ulna -	6	83	100	4	100	50
Femur -	38	73	76	20	80	70
Tibia (shaft) -	22	59	68	34	61	64
Fibula (shaft) -	4	50	100	6	50	16
Tibia and fibula -	50	60	60	82	65	68
Totals -	129	—	—	153	—	—

Observe that the percentage of good functional results is higher in the patients operated on, except in compound fracture of both bones of the leg ; in the non-operative cases there is a higher percentage of good anatomical results. This is contrary to the established canon that good anatomical results are followed by a high percentage of good functional results ; but it must not be taken that operative treatment is the best treatment in compound fractures. It is generally known that the occasional fixation of a compound fracture by means of a plate and screws has been followed by very good

results. Yet it is certain that a universal adoption of this method would be followed by a high percentage of bad results.

The average duration of incapacity was noted in 51 cases :—

Site of Injury	Period
Femur - - -	13 months
Leg - - -	6 "
Upper extremity -	4 "

There was no marked difference between operative and non-operative cases.

In an interesting article on fractures of bones in gold mining by J. W. Freeman,⁵⁵ there is a useful note on fractures from an economic standpoint. The mining company pay their workers an average wage of \$3.25 per day. If a workman is injured, for every dollar the man loses in wages the company spend a like amount to get him well. When he is injured, his pay stops, but he draws \$1.00 per day from an Aid Fund, without any expense to himself for surgical services or hospital. For example, a man loses 100 days, equal to \$325.00 ; he draws \$100.00 from the Aid Fund, a loss to him of \$225.00 ; while it costs the company \$325.00, besides the loss of efficiency in breaking in a new man.

In a total of 311 cases of simple and compound fracture, we find the following losses to the employees and to the company :—

Site of Injury	No. of cases	No. of days off	Loss in wages	Received from Aid Fund	Net loss to employees	Cost to company
			\$	\$	\$	\$
Skull - -	25	976	3172	976	2196	3172
Hyoid - -	1	9	29.25	9	20.25	29.25
Vertebrae - -	1	7	22.75	7	15.75	22.75
Clavicle - -	4	182	591.50	182	409.50	591.50
Scapula - -	1	23	74.75	23	51.75	74.75
Ribs - -	25	825	2681.25	825	1856.25	2681.25
Humerus - -	1	117	270.25	117	153.25	270.25
Radius - -	4	89	289.25	89	200.25	289.25
Radius and ulna	5	248	906	248	658	906
Metacarpals -	7	140	453	140	313	453
Phalanges - -	39	721	2343.25	721	1622.25	2343.25
Pelvis - -	6	183	594.75	183	411.75	594.75
Femur - -	10	2137	6945.25	2137	4808.25	6945.25
Patella - -	1	35	113.75	35	78.75	113.75
Tibia and fibula	39	4773	15512.25	4773	10739.25	15512.25
Tibia - -	19	1322	4296.50	1322	2974.45	4296.50
Fibula - -	18	800	2600	800	1800	2600
Tarsus - -	4	360	1170	360	810	1170
Metatarsus -	31	992	3224	992	2232	3224
Toes - -	70	980	3185	980	2205	3185
Totals -	311	14,919	46,365.75	14,919	31,446.75	46,365.75

Pringle⁵⁶ reports on 230 cases of open fracture of the long bones. In 159 patients an attempt was made to save the limb. The general treatment was as follows : The limb was thoroughly cleaned, the wound in the skin and subcutaneous tissue excised, the soft parts were opened up, and all pockets made accessible ; muscle, fascia, and periosteum ingrained with dirt were cut away ; the bones, if necessary, were turned out of the wound and dirt removed ; large fragments were cleaned and preserved ; fixation by means of wires, screws, or plates was employed in some cases, and the wound was always closed if possible. Of the 112 cases treated by fixation, 9 died from various complications, such as pneumonia, chronic Bright's disease, cardiac failure, etc., and secondary amputation was required in 7 ; of the 96 patients whose limbs were saved, all recovered with good union. There were 47 patients treated by cleaning (no fixation) : 4 died of cardiac failure, shock, etc., and secondary amputation was required in 7, the same number as in the fixation class. The length of time required for treatment in hospital in those

whose limbs were saved was, on the average, 62·7 days, the longest period being 200 days. Pringle is a thorough believer in efficient cleaning and fixation in suitable cases. Whilst the internal fixation method may be admissible in certain circumstances in open fractures occurring in civil life, it has caused disaster in gunshot fractures.

There can be no doubt that in the treatment of comminuted compound fractures of the shaft of the femur or tibia, the use of the Pearson or Watkin Williams' caliper is of very great value in suitable cases and tends to improve the end-results.

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FRIEDREICH'S ATAXIA.—(See ATAXIAS.)

FRONTAL SINUSITIS.—(See NASAL ACCESSORY SINUSITIS.)

GALL-BLADDER, INFLAMMATION OF.—(See CHOLECYSTITIS.)

GALL-STONES.—We shall inquire (A) *Into the prospect of severe trouble arising from the presence of gall-stones*; and (B) *Concerning the risks and benefits of the various forms of operation*.

A. The Prognosis of Gall-stones apart from Operation.—As is well known, gall-stones are very frequently found at the autopsy in cases where their presence was never suspected during life. They are said to be present in 4 per cent of all adult males and 20 per cent of all adult females, and are undoubtedly commoner in the obese. Only in about one-fifth of the cases are typical attacks of gall-stone colic recognized.

As Moynihan has forcibly pointed out, this does not mean that the remaining four-fifths never have any symptoms. A large proportion of them have uneasy sensations of fullness, which may amount to agonizing attacks of pain, not in the right hypochondrium but in the stomach. It is not at all uncommon for a very exact mimicry of gastric ulcer to be the result, and it may even be supposed from the severity of the symptoms that the ulcer has perforated. In a number of these cases hyperchlorhydria is found, and some of them do actually develop a gastric ulcer in consequence.

The natural course of cholelithiasis, therefore, presents three stages; some patients never reach the third, and some do not even reach the second. The stages are:—

1. *Stage of Cholecystic Indigestion.*—This may begin between the ages of thirty and forty, and last ten or twenty years. The special features are flatulent dyspepsia, a sense of fullness in the stomach after meals *without* the brief relief that taking food gives to a patient with gastric ulcer, and sometimes vomiting, which relieves the discomfort. There is a

qualitative indigestion—a special liability to symptoms after eating oils, fried food, and raw apples (Mayo).

2. *Stage of Biliary Colic*.—Violent attacks of pain, with or without jaundice, are due either to infection of the bile-passages, or to movements of a stone in the ducts. When the patient has had one definite attack, in the great majority of cases others follow, but at very irregular intervals. Occasionally, but rather rarely, the attacks may cease altogether. If a stone is passed per rectum, the presence of facets shows that others remain behind.

3. *Stage of Serious Complications*.—In about 20 per cent of the cases which are sufficiently severe to come into hospital for operation, a stone becomes impacted in the common bile-duct, and in a further 10 per cent in the cystic duct (Kehr, Mayos, the Bristol figures). Stone in the common duct causes persistent jaundice and pain, and sometimes febrile attacks; stone in the cystic duct gives rise to dilatation of the gall-bladder, either simple (mucocele) or infected (empyema of the gall-bladder).

Another trouble resulting from gall-stones may be a *fistulous opening* into the peritoneal cavity, some viscus, or on the skin surface. In Courvoisier's statistics collected from the literature, there were 184 cases of cutaneous fistula (usually at the umbilicus), 119 of perforation into the peritoneal cavity, 83 into the duodenum, 39 into the colon, 24 into the lung, and a very few each into the stomach, kidney, and ureter. In 4 cases (one of whom was Ignatius Loyola) the inferior vena cava was opened by a gall-stone fistula.

Acute cholecystitis is a quite common consequence of stones in the gall-bladder, and occasionally leads to perforation and peritonitis. Subphrenic abscess or abscess of the liver may also result.

Intestinal obstruction due to gall-stones is rare, but many hundreds of cases are on record. Of 280 in the literature, 156 died (Martin), but the literature statistics are seldom very valuable. Occasionally, adhesions around the bile-passages may lead to intestinal obstruction.

Cancer of the bile-ducts or gall-bladder is a well-recognized consequence of the long-continued irritation of calculi. We have some figures giving us an idea of the frequency of this result. Cancer was present in 18 out of 409 cases at the London Hospital, and 45 out of 333 cases at Guy's. The greater frequency is due to the older date of the statistics; nowadays many more cases are operated on early. Combining these figures, we obtain a frequency of 8 per cent; the ancient statistics of Riedel were as high as 28 per cent. It will be seen, however, that the danger of cancer is by no means negligible if even 8 per cent of patients with symptoms sufficiently severe to be operated upon already show it. Walton records 3, and Mayo Robson and Lawford Knaggs 1 each, cases in which cancer has supervened *after* operation, but this is evidently extremely rare. In the end-result statistics of Kehr, Davis, Arnsperger, McWilliams, Stanton, and the Bristol figures, comprising nearly a thousand in all, this sequel is not once mentioned.

We conclude, therefore, that in the majority of cases the presence of gall-stones leads to some discomfort, which in about one-fifth of the cases is very severe, though it may be only temporary; that of those in whom cholelithiasis is definitely diagnosed, about one-third eventually suffer from impaction of a gall-stone, or develop a fistula or acute cholecystitis demanding prompt interference; that another 8 per cent go on to cancer of the bile-passages, and that a small proportion, perhaps 1 per cent, lose their lives from intestinal obstruction, perforative peritonitis, pancreatitis, or subphrenic abscess.

It is scarcely realized by the profession that the prognosis of gall-stones, apart from treatment, is as grave as these facts prove. It will probably be admitted by nearly everyone that the prospects of permanent relief of symptoms by medical treatment—olive oil, salines, mineral waters and spa treatment, dieting, etc.—are very slight, and any patient who has had one attack of hepatic colic will most probably get others. Fortunately these are often at long intervals, so that life may be tolerable notwithstanding.

B. Prognosis of Operation for Gall-stones.—We shall consider, first, the operation mortality and its causes, and then the prospects of permanent cure.

1. *Operation Mortality*.—As a glance at *Table I* will show, it is impossible to give a figure for the death-rate of the operation for gall-stones which will not be utterly misleading if applied to particular cases without discrimination. All depends upon the exact nature of the individual's condition.

In absolutely straightforward, uncomplicated cases, the mortality is very low. Sir D'Arcy Power records 27 such without a death; Kehr collects statistics of 2494 operations of this type with a mortality of 3.6 per cent. On the other hand, in the presence of 'serious complications', including cancer, peritonitis, infection with fever or pus, gastric ulcer, etc., most of the statistics range about 50 per cent.

Table I.—THE OPERATION MORTALITY FOR GALL-STONES.

Author	All cases		Stones in Gall-bladder		Duct cases		Serious complications	
	No.	Died	No.	Died	No.	Died	No.	Died
		per cent		per cent		per cent		per cent
D'Arcy Power - - - - -	73	23.3	53	11.3	—	—	20	55.0
Kehr - - - - -	1600	16.5	691	2.9	389	3.3	520	44.6
Bristol Royal Infirmary - - - - -	84	13.0	31	9.6	27	11.0	12	42.0
Arnsperger - - - - -	230	6.9	—	—	—	—	—	—
Mayo - - - - -	4000	2.75	1164	2.5	105	2.9	102	24.0
Mayo Clinic, 1919 - - - - -	—	—	1000	1.6	139	8.6	—	—
Willis - - - - -	549	2.2	—	—	44	11.0	—	—
Deaver - - - - -	1914	6.3	—	4.5	—	5.0	—	—
Hubbard and Kimpton - - - - -	226	14.0	—	—	—	—	—	—
Lichty and Zurhorst - - - - -	137	8.0	—	—	—	—	—	—
Barling (private cases) - - - - -	100	6.0	—	—	—	—	—	—

Sir D'Arcy Power quotes 73 cases under his observation in St. Bartholomew's Hospital from 1900 to 1912. The total mortality is high (23.3 per cent), because in England it is principally the severe or complicated cases that are sent to a hospital. He does not distinguish between stones in the gall-bladder and in the ducts. The Bristol Royal Infirmary figures, representing the practice of nine surgeons during the years 1900–11, are very similar, but present a smaller proportion of serious complications, so that the total death-rate is less. Even in the absence of such serious complications, about 1 in 10 die.

Kehr, of Halberstadt, who performs an enormous number of operations for gall-stones, can quote 1600 cases, his total death-rate being rather higher than that in the Bristol series, but in uncomplicated cases his results are much better, the mortality being 2.9 per cent when the stones are in the gall-bladder and 3.3 per cent if in the ducts. The statistics run over twenty years.

The Mayos also record a long series, and they appear to deal with a much simpler type of case than the English or German material, so their total death-rate is only 4.4 per cent. Their figures in uncomplicated cases are a little better than Kehr's, and much better than the English. There is little doubt that when it becomes the rule to call in the surgeon early instead of late, the death-rate will fall considerably. In the year 1919, ten surgeons operating on 1000 cases at the Mayo clinic in Rochester had a death-rate of 1.6 per cent; in 139 cases of stone in the ducts, the mortality was 8.6 per cent.

In Hubbard's cases, of the 31 deaths, there were septic complications in 8, and stones were found in the ducts in 16.

Sir Gilbert Barling reports a mortality of 6 per cent in 100 private cases.

It is not possible to use statistics of mortality to decide on the relative merits of cholecystostomy versus cholecystectomy, as will be obvious from the following table:—

Table II.

Author	Cholecystostomy		Cholecystectomy	
	Cases	Died per cent	Cases	Died per cent
Mayo, earlier series - - - - -	845	2.1	319	3.1
Mayo, later series - - - - -	43	14.0	776	1.8
Kehr - - - - -	307	2.2	384	3.3
Deaver - - - - -	40	2.2	115	5.2
Willis - - - - -	398	1.7	107	0.9

It is perfectly clear that what makes the difference is not so much any increased severity of the operation when the gall-bladder is removed, but the surgeon's preference as to which type of procedure he shall adopt in the simpler or the more serious cases respectively.

In all the figures, the common-duct cases show a mortality rather higher than those with stones in the gall-bladder only.

In the Bristol figures, it was very remarkable to observe how the formation of adhesions affected the prognosis. Of 19 cases with extensive adhesions, 30 per cent died.

The causes of death are illustrated by the Bristol statistics : shock, 3 cases ; peritonitis, 3 ; gastric ulcer, 2 ; fatty heart (twenty-one days after), 1 ; pneumonia, 1 ; cut portal vein, 1 ; intestinal obstruction, 1. Cancer also accounts for some fatal results. A few jaundiced patients die of persistent hæmorrhage. According to Whipple, the one life-saving procedure when this complication occurs is to give from 200 to 500 c.c. of calcium lactate intravenously, in a 0.2 per cent solution in normal saline. This lowered the coagulation time to one-third or one-half in the eight cases in which it was used, and invariably stopped the oozing.

Some writers describe a post-operative cessation of the hepatic functions, characterized by absence of bile, fever, vomiting, and death. Both Kehr and Sir D'Arcy Power remark that the death-rate is much higher in males than females, being approximately double.

2. *The Prospects of Cure.*—We have available several series of end-results of cases followed for periods varying from one to ten years after operation, and representing English, German, and American practice. In *Table III*, all forms of operation for gall-stones are classed together.

Table III.—PROSPECTS OF RELIEF AFTER OPERATION FOR GALL-STONES.

Author	Number traced	Cured	Better	Unrelieved	Incisional hernia	Second operation
		per cent	per cent	per cent	per cent	per cent
Arnsperger - - -	147	64.6	19.7	6.9	8.8	?
Stanton - - -	245	79.0	15.0	6.0	3.0	2.0
Bristol Royal Infirmary -	59	52.5	32.2	15.2	5.0	6.7
Hubbard and Kimpton -	91	81.0	5.0	8.0	—	—
Lichty and Zurhorst -	112	74.0	11.9	7.0	—	—
Collins - - -	102	74.0	15.0	13.0	—	—
Graff and Weinert -	130	73.0	—	26.0	—	—
Mayo - - -	219	71.0	22.0	7.0	—	—
Buchanan - - -	282	78.5	—	—	—	—
Barling - - -	94	93.0	1.0	4.0	—	2.0

Arnsperger records the cases operated on at Heidelberg in the years 1907–9, it being customary to remove the gall-bladder. Both he and Davis specially warn against stitching the gall-bladder to the abdominal wall. It will be seen that about two-thirds of the patients were cured and only 6.9 per cent were unrelieved. Stanton gives the end-results from Ochsner's clinic, where the results are better, perhaps on account of earlier operation. The Bristol figures are from the same series as was quoted under the heading of mortality, and show only about half cured, but another third improved ; perhaps the difference between this and the other reports is principally in the use of the word 'cured', which in the Bristol table is taken to mean absolute freedom from symptoms.

The more modern American and German statistics, representing to a larger extent than the English an early operation on a type of case not yet complicated by adhesions or septic troubles, show a remarkable uniformity of end-results. The cures range around 73 per cent, and the failures about 10 per cent. These figures are mostly taken from hospital practice. The 219 patients reported by Mayo of Rochester were treated by cholecystectomy, and were not reckoned until at least a year had elapsed after operation. Buchanan's series were nearly all cholecystostomies.

Sir Gilbert Barling's figures relate to 100 cases in his private practice. Taking all together, we may conclude that about 75 per cent are cured by operation and 15 per cent relieved, but the remainder, about 10 per cent, are not improved. What

are the causes of lack of success? Principally three: (a) Recurrence of the stones; (b) Adhesions; and (c) Incisional hernia. Second operations have often been performed, so that we are informed as to the relative frequency of these. Thus:—

Arnsperger—	gall-stones	11 cases;	adhesions,	13 cases
McWilliams—	„	8 „	„	4 „
Stanton—	„	8 „	„	10 „
Bristol Royal Infirmary—	„	1 „	„	3 „
Deaver—	„	18 „	„	8 „

It is very difficult to say whether the gall-stones are new formations, or stones overlooked and perhaps increased in size since the first operation; probably the latter is more usual. It is quite certain, however, that reformation may take place after cholecystostomy. Foss reports a case in which this operation was performed three times and the gall-bladder thoroughly cleared, but at a fourth operation contained 500 small stones. In another case (Clark) seven large stones were found in a gall-bladder which had been emptied and drained a year before. On the other hand, Kehr admits having overlooked a stone in 2.5 per cent of 1105 operations. Deaver reports that second operations constituted 4 per cent of 1189 explorations of the bile-passages. In 60 per cent of these the second operation was within a year; in 30 per cent within three years.

Of other causes of recurrent symptoms, adhesions is the most important. In many cases it will be associated with latent sepsis of the gall-bladder. A few second operations are necessitated by biliary or mucous fistula, stricture of the ducts, or chronic pancreatitis. Incisional hernia occurs in from 3 to 10 per cent of all cases; often it gives but little trouble.

It is noteworthy that there is sometimes an attack of severe pain and jaundice soon after the operation, which therefore appears to have failed, followed by permanent cure. This is noted by Munro, and was seen in three Bristol cases. It is probably due to catarrh of the ducts.

Removal of the gall-bladder is not a certain preventive of re-formation of calculi; Arnsperger relates three cases in which they recurred in the common duct. Nevertheless, cholecystectomy probably gives better end-results, both as regards recurrence of stones and also the formation of adhesions due to cholecystitis, than drainage operations. This is difficult to prove by statistics, because so much depends on which is the operation of choice in the most unfavourable type of case. A small series of comparable cases has been published from the London Hospital by Warren, showing to the advantage of excision. C. H. Mayo gives figures as follows, taken from the period when he was turning more and more to removal of the gall-bladder as his normal procedure. All cases were reported over one year afterwards.

	Cases	Cured	Improved	Not improved
		per cent	per cent	per cent
Mayo { Cholecystostomy -	242	53	39	9
Cholecystectomy -	219	71	22	7
Barling { Cholecystostomy -	42	90	—	10
Cholecystectomy -	52	94	—	6

There has undoubtedly been a great turn-over of surgical opinion in favour of cholecystectomy of late years.

There is not much difference in the end-results whether the stones were in the gall-bladder, the cystic duct, or the common bile-duct. In Stanton's series, the common-duct cases gave the most failures, whereas in the Bristol series there were very few of these who did not get relief. The principal factor in determining the end-result is the amount and density of adhesions found. In the Bristol cases with extensive adhesions, 6 out of 19 died and 36 per cent were unrelieved, whereas in the absence of adhesions only 10 per cent failed to obtain benefit. Stanton reports that of 107 uncomplicated cases of stones in the gall-bladder, only 5.4 per cent were unsatisfactory.

We conclude, therefore, that in simple, early cases the mortality of operation is about 2 per cent, and that 90 per cent will be greatly benefited; that in the type of case which

used usually to be operated on in England after months or years of recurrent gall-stone colic, 10 per cent die and about 85 per cent of the survivors are relieved ; and that in cases with serious complications such as infection, perforation, cancer, etc., about 50 per cent die, and relief is likely to be incomplete in most of the patients. It is evident, therefore, that to obtain the best results from the operation for gall-stones, it ought to be undertaken decidedly earlier than is now the custom. For this reason, the figures of a few enterprising American surgeons are better than those of average English practice.

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A. Rendle Short.

GANGRENE.—The prognosis of this disease depends, of course, upon the cause of the gangrene. That due to anaerobic wound infections is dealt with elsewhere (see GAS GANGRENE). Gangrene due to Raynaud's disease is likely to lead to loss of the finger-tips, but there is no danger to life. When due to frost-bite, to embolism of a main artery, or to injury, it will, of course, necessitate amputation ; but there is no great danger of the gangrene spreading, or of life being imperilled, unless, owing to delay, septic infection from the dead area takes place.

We shall particularly consider here the outlook in cases of senile and diabetic gangrene : (1) *In relation to the limb* ; (2) *In relation to the life of the patient* ; and (3) *In relation to the treatment*.

1. Prognosis as to the Limb.—It is often difficult to be sure exactly how much of a limb is irretrievably affected. Sometimes the skin turns black, but the deeper structures are living. When, however, the duskiness appears to be deep-seated, and the region, usually the foot, is painful or no longer sensitive to pressure, it is beyond recovery. If a line of demarcation forms, it is no use to expect, in senile or diabetic cases, that this will be the limit of the advance of the gangrene ; though in traumatic or embolic gangrene, or in cases of frost-bite, where the artery is blocked at a particular point, the disease does not usually spread above a line of demarcation. In senile cases, one only too often sees, after a while, a spreading duskiness even above the line, and the process gradually advances up the leg if it is allowed to do so. The writer recollects seeing in a workhouse an old pauper who developed gangrene of the toe, which extended, in the course of years, up the leg to the middle third of the thigh ; but for seven years he persistently refused amputation, and still retained possession of his dry, black, stinking leg ! Such a case is unusual ; most patients would have died of septic intoxication long before.

In many cases it is possible to foretell how much of a limb is in danger by feeling how far down the arteries can be found pulsating, and by taking a skiagram to see how far up the vessels the calcareous changes extend.

2. Prognosis as to Life.—This is usually grave in an untreated case, and depends upon the rapidity of advance of the gangrene, the age and condition of the patient, and the degree of septic absorption. Much sugar in the urine makes the outlook more ominous, and if there is a good deal of fever, and the dead area is moist, nothing but early amputation is likely to save the patient's life.

3. Prognosis as influenced by Treatment.—It is quite useless, in a senile or diabetic case, to amputate at the site of any line of demarcation that may have formed. Nor has the operation of making an anastomosis between the femoral artery and vein met with success save in a very few exceptional cases. The treatment remaining, therefore, is to amputate through the lower third of the thigh or, in early cases with pervious arteries, at the site of election. The amputation conducted under such circumstances is by no means a trifling risk. Of 39 cases so treated at two London hospitals, the Middlesex and St. Thomas's, from 1907 to 1911, 16 died shortly afterwards, a mortality of 41 per cent.

A. Rendle Short.

GAS GANGRENE.—Gas gangrene is a clinical term used to denote a spreading infection commencing most often in damaged muscle, and due to one or more varieties of gas-forming anaerobes, of which the most important are the *B. perfringens* or *B. welchii*, the *Vibrio septique* of Pasteur, and the highly toxic *B. œdematiens*. These three organisms, either singly or together, are responsible for most of the acute fulminating cases of gas gangrene. *B. welchii* is the commonest, and *B. œdematiens* the least common. *B. sporogenes*, *B. histolyticus* (Weinberg), and other less dangerous non-pathogenic anaerobes, such as those described by McIntosh, are responsible for some part in the production of gas gangrene, the exact amount of which is not yet fully determined. The gravity of the infection varies with the organism found, and in the order in which they are mentioned above. At the beginning of the war the disease was little known, and terrible in its consequences. With multiplied experience has come greater knowledge and vastly improved methods of treatment, rendering the prognosis much less grave. The prognosis depends upon many factors, of which the more important are indicated in the headings of the paragraphs below.

Anaerobes are abundant in the highly-fertilized soil of Flanders and Northern France. They are carried by projectiles into a wound with the trench mud that clings to the clothing and skin of the soldier. Fæcal contamination of the clothing and skin of the buttocks and thighs is another source of infection of a wound with anaerobes.

Characters of the Wound.—The severity of the infection varies with the character of the wound. Gas gangrene most commonly starts in wounded muscle. Hence projectiles such as ragged fragments of shell or bomb-casing, by causing extensively lacerated wounds of muscle, are more often followed by gas gangrene than are the wounds caused by shrapnel balls or undistorted rifle bullets.

Concomitant injury to the arterial supply to the part renders the prognosis graver. Wounds of the popliteal artery associated with wounds of the calf muscles were nearly always followed by the development of gas gangrene in the calf muscles.

Compound fractures are associated with considerable tearing of muscle and with the formation of large hæmatomata, and are therefore favourable sites for the disease.

Types of Disease.—Gas gangrene may start acutely, and run a rapid, quickly-spreading course; or it may begin subacutely, remaining for some time more or less localized. In the fulminating cases death may occur in from twenty-four to thirty-six hours.

The subacute case is the type for which local surgical measures may be employed, while amputation is nearly always required to save life in the acute type.

Stage of the Disease.—The prognosis becomes rapidly graver with the length of time the disease has been established before the patient comes for treatment. An amputation, however, will frequently save life, although performed through crepitant tissues, provided the upper ends of the infected muscles or group of muscles be properly dealt with (see under 'Results of Treatment').

A profound toxæmia, manifested by extreme pallor, vomiting, and a rapid, very small, and occasionally wholly imperceptible radial pulse, are signs of grave import. Amputation is here the only hope, but fortunately is sometimes successful, even in profoundly toxic cases.

In cases that have developed gas gangrene in a wound, metastatic abscesses containing gas and purulent offensive fluid are seen at times at the sites of saline infusions, morphia injections, and occasionally in contused areas not actually wounded by shell fragments. At this septicæmic stage, treatment is of little avail.

Site.—The disease is most commonly met with in the lower extremity, the source from which the infection is derived being the soil and fæcal contamination. The danger to life is less when the upper limb is affected than when the lower limb is the seat of the disease.

Where the muscles of the buttock are attacked by the acute spreading type of the infection, the prognosis is generally grave. The same applies to a slightly less extent to the muscles arising from the scapula.

Gas gangrene of the abdominal wall, especially the muscles of the posterior abdominal wall and loins, is too frequently the cause of death in cases of gunshot wound of the abdomen, even where multiple injuries to the intestines have been dealt with successfully

by operation. Anaerobic infection of the liver around retained shell fragments and clothing is very lethal.

Anaerobic infection of a hæmothorax is a grave condition, necessitating prompt resection of a rib or ribs to save life. Many cases die even after irrigation and efficient drainage of the pleural cavity.

Shock and Other Factors.—Multiplicity of wounds renders the prognosis much worse. When the patient is suffering from shock or collapse the infection tends to run a more rapid course. Any condition therefore that tends to aggravate existing shock or collapse will make the outlook less favourable. Such conditions are: (1) The position and character of the wound or wounds; (2) Unrelieved pain, e.g., from a badly-splinted fracture; (3) A long and fatiguing journey in a jolting ambulance; (4) Exposure to cold and inclement weather; (5) Anæmia from excessive bleeding; (6) Loss of fluid from vomiting; (7) Starvation.

Wounds of a large artery, resulting in the cutting off of the blood-supply of the wounded muscles below, are frequently followed by a massive gangrene involving the whole limb below the vascular lesion. The popliteal and posterior tibial arteries more commonly, and the brachial artery less commonly, are the best instances of this.

Results of Treatment.—Briefly the essentials of treatment are: the making of adequate incisions, thoroughly exposing the limits and recesses of the wounds in the muscle; the removal of foreign bodies, including clothing; the excision of infected muscle and muscle likely to become infected; the provision of good drainage; and the adoption of certain methods of post-operative dressing.

The success of local excision of muscle in the early stages depends on a knowledge of two main principles: first, that spread of the disease takes place in the length of the muscle infected, whereas spread across between neighbouring groups of muscles, or even contiguous unwounded muscles of the same group, is rare; secondly, that all infected muscle must be removed as thoroughly as possible. In the early stages, infected muscle is a dirty brick-red in colour, does not contract to mechanical stimuli, and often does not bleed on section. The odour of the gangrenous muscle is characteristic.

In the acute fulminating cases, and those where there is massive gangrene below an arterial injury, amputation is the only resort. The amputation should be performed, when possible, above the origin or upper limit of the muscle group affected. Where this is not possible, recourse must be had to resection of the remains of the muscle in the stump. The maximum of drainage of the stump is necessary whenever the amputation is near the wound, or where there is cause to think that, by force of circumstance, it may have been performed through infected tissues. For this reason the guillotine method in the early days of the war, despite its detractors, saved many lives. In many cases, however, it was possible to cut flaps, and even to stitch them lightly over Carrel's tubes, B.I.P.P., or a salt-pack, if it was certain no infected muscle had been left behind in the stump. Further experience showed that excision of all infected muscle in a wound or amputation stump, and the application of a flavine pack, followed by secondary suture of the wound forty-eight hours or more after excision or amputation, was followed by better results. Excision and primary suture of a wound, in the absence of a secondarily infecting hæmolytic streptococcus, resulted in many cases in first-intention healing. The recognition that thorough and scientific removal of the dead, damaged, and infected tissues was the root principle of all treatment of gas gangrene and other infections, was directly responsible for the success that rewarded operative interference in dealing with the abdominal, thoracic, and abdomino-thoracic wounds that had so high a mortality at the beginning of the war, for success depended upon per-primam healing.

It is important to emphasize the fact that gas in the subcutaneous tissues is no contra-indication for the performance of an amputation through such emphysematous tissue. If the source of the gas—i.e., the underlying muscles—is removed, the subcutaneous emphysema will frequently disappear under the influence of multiple small incisions; often the skin passes through the creamy-brownish colour-changes described below. For instance, though a wound of the quadriceps femoris may become gangrenous and gas may spread well above Poupart's ligament, an amputation high up in the thigh, with incisions of the crepitant tissues above, will sometimes save a life.

The later colour-changes in muscle, described by Cuthbert Wallace, are of pathological

rather than prognostic value. The colour-changes in the skin are, however, of somewhat more moment. The pallor and shininess of the initial stages are due to tension over the swelling part, and are early in their appearance. Where a limb becomes massively gangrenous, or over and round a fulminating focus, the skin becomes successively purple-green to black. Blebs of blood-stained fluid form, burst, and expose a raw purplish area. Dead-white patches are intermingled with the purple. When this condition is seen, amputation high up is indicated. A brownish-cream-coloured spreading pigmentation of the skin and subcutaneous tissues occurs in the subacute forms of the disease. It is not of grave import, but should be treated by multiple incisions.

Where much muscle has been resected, efficient splinting should always be provided.

The administration of intravenous 4 per cent solution of sodium bicarbonate in normal saline was frequently of great service in gas-gangrene toxæmia. An anti-gas-gangrene serum has been prepared, and should be administered as soon as possible. It is protective and antitoxic. Probably it should be used as a prophylactic in the same way that anti-tetanic serum was used during the war.

The subjoined tables have been compiled from a consecutive series of 131 cases that passed through the operating theatre of a casualty clearing station. The mortality is probably low, in that it represents only the mortality after operation. Certain cases admitted were too ill for operation, and thus are not shown in these lists.

Table I.—MORTALITY OF THE TWO MAIN TYPES OF THE DISEASE.

Region	ACUTE OR SPREADING		SUBACUTE OR LOCALIZING		Total
	Recovered	Died	Recovered	Died	
Head and neck	—	1	1	—	2
Scapular region	—	—	1	—	1
Chest wall	—	—	1	—	1
Abdominal wall	—	—	1	—	1
Back	—	—	1	—	1
Upper arm	4	—	7	—	11
Forearm	5	—	2	—	7
Buttock	—	1	3	—	4
Thigh	12	11	22	—	45
Leg	17	6	23	2	48
Foot	1	—	8	—	9
	Mortality 48·72 per cent		Mortality 2·86 per cent		131

Table II.—RESULTS OF METHODS OF OPERATION IN RELATION TO SITE.

Site	CONSERVATIVE OPERATION		AMPUTATION		REQUIRING SECOND OPERATION	
	Recovered	Died	Recovered	Died	Recovered	Died
Head and neck	1	1	—	—	—	—
Scapular region	2	—	—	—	—	—
Chest wall	1	—	—	—	—	—
Abdominal wall	1	—	—	—	—	—
Back	1	—	—	—	—	—
Upper arm	5	—	4	—	2	—
Forearm	2	—	5	—	—	—
Hand	—	—	1	—	—	—
Buttock	3	1	—	—	—	—
Thigh	26	1	6	8	1	3
Leg	22	1	12	4	6	3
Foot	6	1	3	—	—	—

Table III.—RESULTS OF METHODS OF OPERATION IN RELATION TO TYPE.

Type	CONSERVATIVE OPERATION		AMPUTATION		REQUIRING SECOND OPERATION	
	Recovered	Died	Recovered	Died	Recovered	Died
Acute spreading -	7	2	25	11	9	6
Subacute localizing -	63	1	6	1	—	—

The term 'Recovered' is used to denote patients sufficiently recovered to travel to the base. Here again, therefore, the end-mortality may be slightly higher than stated. By the term 'Conservative Operation' is meant an operation where the wound was opened up, infected muscle and other obviously devitalized tissue excised, and good drainage provided for. Cases under the heading 'Requiring Second Operation' were those in which an original 'conservative operation' was performed, which was followed in from one to three days by an amputation or multiple incisions on account of further spread of the disease. These figures were compiled from cases treated before September, 1917, and consequently show the mortality of the early days before primary and delayed primary suture were being extensively employed as recognized methods of treatment. Later figures would probably show a lower mortality.

C. H. S. Webb.

GASTRIC ULCER.—(See STOMACH, MEDICAL AFFECTIONS OF; STOMACH, SURGICAL AFFECTIONS OF.)

GASTRITIS.—(See STOMACH, MEDICAL AFFECTIONS OF.)

GASTROPTOSIS.—(See STOMACH, SURGICAL AFFECTIONS OF.)

GAUCHER'S DISEASE.—(See ANÆMIA, SPLENIC, OF ADULTS.)

GENERAL PARALYSIS.—(See MENTAL DISEASES.)

GENU VALGUM.—In young children with rickety deformities, this condition may improve in the course of years, with splints and a more suitable dietary; but in older children and young adults the deviation of the knees is likely to be permanent,* and may increase up to the age at which growth ceases. The success of treatment depends much on the technical skill of the individual surgeon, but it is usually possible to obtain an excellent result at a small risk by the Macewen operation, or by taking a wedge out of the tibia.

A. Rendle Short.

GENU VARUM.—(See RICKETS.)

GERMAN MEASLES.—(See RUBELLA.)

GLANDERS.

Acute Glanders.—This is an extremely fatal disease; the mortality is over 90 per cent. Death occurs in from one to three weeks. Only if the lesion is localized and no internal organ is affected can a favourable termination be hoped for. The appearance of a pustular eruption is highly ominous.

Chronic Glanders.—Half of these cases are fatal. In this form, also, so long as the disease is localized and the internal organs are not attacked, recovery may result. But the course of the disease is always tedious, and the patient is always subject to the risk of the occurrence of an acute attack.

E. W. Goodall.

GLAUCOMA.—The term 'glaucoma' includes every condition in which the intra-ocular pressure is increased. Glaucoma is therefore a symptom, and it occurs in a number of conditions with different pathology. In any consideration of the subject it is essential to keep in mind some details of physiology and pathology.

PHYSIOLOGY AND PATHOLOGY OF GLAUCOMA.

Physiology : The Intra-ocular Pressure.—This is the result of a balance between the formation of aqueous fluid within the eye and its escape from it.

The aqueous is formed by the processes of the ciliary body. Some of it leaves the eye by the suprachoroidal lymph-space and the lymph-spaces about the *venæ vorticosæ*. A small proportion passes into the vitreous and leaves the eye by way of the canal of Stilling and the lymph-spaces about the central retinal vessels. The greatest part of the aqueous passes between the fibres of the suspensory ligament of the lens (zonule of Zinn) into the posterior aqueous chamber, and through the pupil into the anterior chamber. At the periphery (angle) of the anterior chamber is a region where Descemet's membrane breaks up into a number of rods (pillars of Fontana) each with a covering of endothelial cells. This region is the *ligamentum pectinatum iridis* (*cribriform ligament*). The spaces between these rods (the spaces of Fontana) are continuous with the anterior chamber, and by them the aqueous comes into contact with the wall of a venous plexus—the canal of Schlemm—which lies deep in the cornea at the corneoscleral junction. The wall of the canal of Schlemm consists of a single layer of endothelial cells, and through it the aqueous passes into the canal and thence to the anterior ciliary veins and so out of the eye.

Anything which impedes the circulation of the aqueous tends to increase the intra-ocular pressure and cause 'glaucoma'.

Pathology.—The interference may occur at three places, at the zonule, at the pupil, and at the angle of the anterior chamber.

Obstruction at the zonule depends upon the fact that this is situated between the equator of the lens and the tips of the ciliary processes, and this space may be encroached upon by increase in size of either the lens or the ciliary body. The lens increases in size throughout life, and from this cause the liability to glaucoma increases with age. Rapid increase in the size of the lens occurs in traumatic cataract, and more rarely in the absence of trauma ('acute cataract').

Increase in size of the ciliary body occurs when that structure is congested, a fact which bears upon the well-known association of glaucoma with worry and with the nervous temperament.

In eyes which are congenitally too small the circumlental space is unduly narrow, while the lens, being developed from the surface epiblast and not from the optic vesicle, is of the full normal size. Hence an eye which has a cornea less than the normal size is an eye which is especially liable to glaucoma.

Short of obvious mal-development, a highly hypermetropic eye is liable to glaucoma, not only from its being smaller than normal, but also from its having a ciliary muscle abnormally developed to cope with its refractive error.

If there is obstruction at the zonule, an undue proportion of the aqueous passes back into the vitreous, the pressure in the vitreous chamber is increased, and the lens, ciliary processes, and iris are pushed forward, causing the shallow anterior chamber which is characteristic of 'primary' glaucoma. This forward displacement of the ciliary processes results in the base of the iris becoming pressed against the back of the cornea in the region of the pectinate ligament, causing a further grave impediment to the escape of aqueous from the eye.

If the original error (say congestion of the ciliary body) passes off soon, the angle of the anterior chamber may regain its original form and the eye be none the worse for its attack of acute glaucoma. If, on the other hand, the obliteration of the angle of the anterior chamber is prolonged, and still more if it be filled with inflammatory exudate, the histology of the region becomes permanently changed and the eye becomes the subject of chronic glaucoma. This point will be considered again later. The difference between the two pathological pictures here presented must be kept in mind, especially in connection with the results of the classical operation of iridectomy.

Obstruction at the pupil to the circulation of aqueous occurs when, as a result of iritis, the pupillary margin of the iris is everywhere bound down to the anterior capsule of the lens (total posterior synechia; *exclusio pupillæ*), or the pupil is filled with inflammatory exudate or scar tissue (*occlusio pupillæ*). Aqueous cannot pass from the posterior aqueous

chamber into the anterior chamber, and it balloons the iris forwards between the points at which it is attached (pupillary margin and the base), producing the condition called *iris bombé*. This simple case of glaucoma is classed as one of 'secondary' glaucoma, but the differentiation of cases of glaucoma into primary and secondary is misleading unless the pathology of each is borne in mind.

Obstruction at the angle of the anterior chamber may arise in several ways. The angle and the spaces of the pectinate ligament may be plugged or overlaid by fragments of lens matter as a result of traumatic cataract or of operations for cataract, or by blood-clot, or by leucocytes and fibrin in cyclitis. The aqueous, apart from containing solid particles, may be so altered in osmotic pressure by dissolved lens matter from an injured lens or by proteins passed with it by an inflamed ciliary body, that it cannot pass into Schlemm's canal.

The angle of the anterior chamber may be obliterated by the base of the iris being pressed forward, as mentioned earlier. In the earliest stage of primary non-congestive glaucoma we have to picture mere *apposition* of the base of the iris to the back of the cornea in the region of the pectinate ligament. In this stage there is no structural change in the parts, and not only may the increased intra-ocular pressure be relieved, but its recurrence may be prevented, and the glaucoma cured, by a sufficiently wide, far-back iridectomy. If the *apposition* of the base of the iris to the pectinate ligament is sufficiently prolonged, or if these parts are glued together by inflammatory exudate from a congested or inflamed ciliary body, apposition is followed by *adhesion*, the angle of the anterior chamber is *permanently* obliterated (total peripheral synechia), and the mechanism of the pectinate ligament and the canal of Schlemm can never function again. These cases provide the field for the newer operations for glaucoma.

The action of atropine and other mydriatics in inducing acute glaucoma is explained by the fact that when the pupil is dilated the iris is far thicker than when the pupil is contracted, and in an eye already disposed to glaucoma may close the angle of the anterior chamber.

Other points in the pathology of glaucoma are still matter for controversy and will not be considered here.

It has now been indicated how varied are the conditions included within the term 'glaucoma'. In many of them the glaucoma is an incident in the course of some other disease of the eye. This group of 'secondary' glaucomas may be disposed of briefly.

PROGNOSIS OF 'SECONDARY' GLAUCOMA.

Increased tension in the course of the treatment of a traumatic *cataract* calls for tapping of the anterior chamber and evacuation of lens débris and dense aqueous. This is a very satisfactory procedure and only hastens the removal of the cataract.

Total posterior synechia from iritis calls for re-establishment of communication between the posterior aqueous chamber and the anterior chamber. If the case is seen sufficiently early, vigorous efforts should be made to break down the adhesions by means of mydriatics (atropine and cocaine). There need be no fear in using mydriatics in the most vigorous fashion in this form of glaucoma. There is no prospect of obtaining full dilatation of the pupil; the most that can be hoped for is to break down the adhesions at one or two points, sufficiently to enable the aqueous to pass into the anterior chamber. If the adhesions are so firm that they will not yield to atropine, an iridectomy must be performed. This may be difficult by reason of atrophy and friability of the iris, and the iridectomy may be no more than a ragged hole in the iris. This will suffice, however, to relieve the increased pressure, provided it remains patent. The success of the procedure depends on the degree in which the iritis has quieted down at the time the operation is performed. There is a possibility that the operation may light up the iritis to fresh activity, with the result that the new opening in the iris may be filled up by fresh exudate, in which case the eye will be in a condition as bad as, if not worse than, before operation. In the best event, the operation results in a good opening in the iris through which aqueous can pass, and through which the patient will see, not perfectly, but as much as 6/18 or 6/12.

Secondary glaucoma from *cyclitis* is one of the most difficult conditions the ophthalmic

surgeon has to manage. The cases differ so much in their behaviour that it is impossible to generalize. Some yield to atropine; others, in which great increase in depth of the anterior chamber indicates obstruction at the angle of the anterior chamber as the dominant factor, are improved by myotics or by tapping the anterior chamber; others quiet down after sclerectomy or trephining; while in other cases the hypertension persists until the eye becomes blind and any operative interference only makes matters worse.

In glaucoma from intra-ocular *new growth* the hypertension is of no importance, as the treatment consists in early excision of the eye.

In glaucoma from intra-ocular *hæmorrhage*, the eye is already spoiled, and pain calls for excision of the eye.

PROGNOSIS OF 'PRIMARY' GLAUCOMA.

There remains the large group of 'primary' glaucomas. Increased intra-ocular pressure, sufficiently severe or sufficiently prolonged, damages the optic nerve and retina, and blindness from glaucoma is due to atrophy of the optic nerve.

In forming an opinion as to the condition and progress of an eye the subject of glaucoma, we rely mainly on examination of four things: (1) Visual acuity; (2) The ophthalmoscopic appearance of the optic disc; (3) The ocular tension; and (4) The field of vision.

1. *Visual Acuity*.—In acute congestive glaucoma, vision is diminished both by opacity of the cornea and by pressure paralysis of the retina and optic nerve, so that in a very short time the vision is reduced to 'hand movements' or less. If the tension is reduced by treatment the cornea clears, but the degree of recovery of the nerve elements varies. With prompt treatment central vision is usually as good, or almost as good, as before the attack; but there are cases where acute glaucoma of twelve hours' duration results in blindness.

In chronic glaucoma, central vision progressively declines from atrophy of the optic nerve. Any vision thus lost is not regained, even though the glaucoma be arrested by treatment. An eye with defective vision for which there is no obvious cause should be suspected of chronic glaucoma, and subjected to a full examination. The better the visual acuity when an eye comes under treatment, the better the prognosis, and the most favourable cases are those in which the vision is still normal.

2. *Ophthalmoscopic Appearance of the Optic Disc*.—The increased intra-ocular pressure in chronic glaucoma causes the sclera to yield at its weakest point, the scleral foramen, and the nerve fibres passing through it become stretched and atrophied, and the disc typically becomes 'cupped' with under-cut margins. The degree of cupping of the disc gives an indication of the extent to which the glaucomatous process has progressed, although one finds cases with deep cupping but good vision, and others with atrophy of the nerve with bad vision but little cupping. It is sometimes difficult to distinguish an early glaucoma cup from a well-marked physiological cup.

3. *The Ocular Tension*.—This is estimated by the fingers—comparing it with the standard which the surgeon has learned to recognize as normal—or by a tonometer. There is an increasing tendency to use these instruments, which enable the tension to be expressed in figures which can be compared during the progress of a case. It must be remembered that the different types of tonometer do not give the same readings, and in noting and quoting tonometer readings the type of instrument used must be specified. With the Schiötz instrument, the limits of normal tension are 16–25; with the McLean they are 22–40. These instruments are most valuable for showing what lowering of tension is produced by myotics, and for judging the results of operation.

4. *The Field of Vision*.—Glaucoma causes two changes in the perimetric field, namely, contraction of the peripheral field, and enlargement of the blind spot. Contraction of the peripheral field may be concentric, but is usually more marked on the nasal side, forming a distinct bay which may have a sharp horizontal boundary ('Roenne's step'—see MEDICAL ANNUAL, 1921, 'Glaucoma'). The contraction may be evident earlier for colours than for white.

In chronic glaucoma there is progressive contraction of the field, and any part of the field once lost is not regained, even though the glaucoma be arrested. The blind area may reach or pass the fixation point (macula), and occasionally, where it is close to

this point, operation results in its passing it, blotting out central vision. This is a risk which must be taken, as, if left to itself, chronic glaucoma ends in blindness. The blind spot becomes enlarged up or down (Bjerrum's sign), and often shows sickle-shaped processes which tend to encircle the fixation point (Seidel's sign). Perimetric charts afford a most valuable indication of the degree in which the eye has been damaged by glaucoma, and of noting the progress of the disease. The slighter the signs, the better is the result of treatment likely to be.

MEDICAL TREATMENT OF GLAUCOMA.

Acute Glaucoma.—Here operation is urgently required, and medical treatment is directed merely to preparing the patient and the eye for operation. One gives a dose of calomel, a hypodermic injection of morphine, applies leeches to the temple, heat to the eye, and instils eserine $\frac{1}{4}$ per cent two-hourly. Almost invariably one finds, six to twelve hours later, the tension lower and the anterior chamber deeper, and the eye a less unpleasant one on which to operate.

Chronic Glaucoma.—The scope of medical treatment is limited in these cases, and should chiefly be confined to cases where no damage has been done to the eye, but there have been minor attacks of hypertension, evidenced by temporary obscurations of vision and by halos around lights (so-called 'premonitory symptoms' of glaucoma). Such treatment consists in avoidance of constipation, stooping, straining, worry, exhaustion, and alcohol, in the use of myotics (weak solutions of eserine or pilocarpine), and in massage of the eye. These measures may keep glaucoma in check for many years,¹ but a patient using this prophylactic treatment must be kept under observation, and should any diminution of visual acuity, change in the field of vision, or increased tension which is not controlled by eserine, be observed, the eye should be operated upon. If a patient cannot be kept under observation, especially if there is a family history of glaucoma, or the eye has a small cornea or a shallow anterior chamber, or still more if the other eye is glaucomatous, it is safer to operate.

Herbert² urges that in chronic glaucoma myotics should always be used for a time, up to three months, before operation is performed. But the risk of an acute attack occurring must always be borne in mind, and the tendency of a patient who has been given palliative treatment to neglect to come for examination until serious damage has been done. In this connection it has been stated that myotics have spoiled more eyes than they have saved.

OPERATIVE TREATMENT.

The Graefe Iridectomy.—The operative treatment of glaucoma dates from 1856, when von Graefe³ introduced the operation of iridectomy for its cure. He found that in most cases of acute glaucoma his operation of making a wide iridectomy as far back as possible resulted in permanent cure, but that in chronic glaucoma the result was often disappointing. Taking all cases, he found, as many writers since have confirmed, that iridectomy resulted in cure in about half the cases. He observed, although it remained for Lagrange later to apply the fact, that 1 in 15 of his cases showed obvious filtration of aqueous in the scar.

In acute glaucoma the Graefe iridectomy is a most satisfactory operation provided that it is performed soon after the onset of the attack. The cornea clears, the eye becomes quiet, the tension falls to the normal, and the vision becomes as good, or very nearly as good, as before the attack. If the glaucomatous process dates only from the onset of the acute attack, the good result of the operation will be permanent.

On the other hand, an acute attack may occur in an eye the subject of chronic glaucoma, with structural changes at the angle of the anterior chamber, in which case, although the operation relieves the acute symptoms, chronic glaucoma may continue, and the eye gradually become blind. Sulzer,⁴ reporting the results of iridectomy for chronic glaucoma in 113 eyes, states that in 71 cases (62·8 per cent) the vision remained as good as, or better than, before operation; in 24 cases (21·25 per cent) the vision diminished after operation, without leading to blindness while the patients were under observation; in 14 cases (12·4 per cent) blindness supervened gradually; while in 4 cases (3·54 per cent) it occurred immediately after the operation. Vettiger⁵ analyzed the late results (three

years at least) of iridectomy in 203 eyes. Of these 52 had acute glaucoma and 151 subacute or chronic. Cases of hæmorrhagic glaucoma were excluded. The results were :—

Result	Acute Glaucoma	Subacute and Chronic Glaucoma
	per cent	per cent
Vision unchanged -	4.34	19.65
Vision improved -	73.91	19.64
Vision worse -	21.74	51.19
Rapid deterioration -	Nil	9.52

It was observed that a Graefe operation badly performed, with a jagged incision and with the iris imperfectly replaced, often resulted in a leaky scar and a satisfactory reduction of tension. Many operators endeavoured to produce such a scar of design, and, up to fifteen years ago, many, in performing iridectomy for glaucoma, intentionally left a piece of iris caught in one end of the scleral wound, hoping to obtain thus a 'cystoid cicatrix'. This device was often effective, but the operation was rather unmanageable, and did not always cure the glaucoma.

The Newer Operations: Sclerectomy.—In 1906 Lagrange⁶ described his operation, which introduced a new principle, that of removing a piece of sclera from the periphery of the anterior chamber, thus providing a permanent path by which aqueous can escape from the anterior chamber under the conjunctiva. In 1909 Holth⁷ described an operation in which a punch-forceps is used for removing the piece of sclera, and in the same year Elliot⁸ described his operation of corneoscleral trephining.

The recent literature of glaucoma is enormous, and the relative value of the above operations, and of many others which aim at producing a subconjunctival fistula, is still the subject of acute discussion. It seems clear, however, that the principle of sclerectomy, for chronic glaucoma at any rate, is one which will survive. All the above operations are capable of producing permanent reduction of increased tension, and the operation which is best for any individual surgeon is that which most appeals to him, and which he performs with the greatest ease and confidence.

With the majority of surgeons the Graefe iridectomy is still the operation of choice for acute glaucoma, although one would think that Lagrange's operation, in which to a wide iridectomy is added a sclerectomy, gives a greater prospect of a permanent cure.

Complications of Operative Treatment.—Iridectomy for acute glaucoma has few and rare complications. It is possible to wound the lens when the anterior chamber is very shallow. If the section is carried too far back, or even with a perfect section, the lens may present and need to be extracted, or expulsive hæmorrhage may occur (*see CATARACT*); but these are rare occurrences, and are almost confined to late cases where the tissues of the eye are degenerate.

Also rare is *malignant glaucoma*, in which pain and hypertension persist after the operation and the eye rapidly becomes blind.

With the newer operations, *late infection* may occur. This is an infection of the eye from the conjunctival sac through the fistulous scar. It is liable to occur if the conjunctival flap has been 'button-holed' at the operation, so that the fistula opens into the conjunctival sac instead of the subconjunctival connective tissue, or if the flap is very thin. In the latter case a foreign body under the upper lid may scratch the thin, œdematous conjunctiva, and allow organisms to pass into the eye. Conjunctivitis must be regarded as a serious disease in a patient who has had a filtering operation performed. Late infection may take the form of a mild iritis which readily yields to treatment, or may be a virulent iridocyclitis which destroys the eye. Greatly varied figures are given of the frequency of late infection, even as high as 7 per cent of cases. The writer, using Holth's and Lagrange's operations, has not had an instance of late infection, and in Elliot's⁹ large experience of his trephining operation he has not had a case of it.

Results of Sclerectomy Operations.—Morax and Fourrière¹⁰ report the condition of 89 patients two years or more after operation, but as they only report the tension a few days after operation, the observation has little value. They state that, in over 500 operations,

late infection occurred four times. Morax¹¹ also reports his results in private practice. He states, "En ce qui concerne la tension et le maintien du *statu quo* fonctionnel, on peut constater 28 bons résultats, 3 passables, 1 mauvais".

The following table shows the results in 35 eyes operated upon for primary glaucoma in the practice of the writer. The tonometer used was McLean's (normal limits 22-40).

Patient	Age	Sex	Eye	Acute or Chronic	CONDITION BEFORE OPERATION		OPERATION		CONDITION AFTER OPERATION		
					Vision	Tension	Date	Nature	Date	Tension	Vision
F. C.	45	F	R	Chronic	6/5 pt.	Tn	21.7.19	Holth	18.8.20	Tn	6/5
F. D.	53	F	L	Chronic	6/9 pt.	Tn.	5.9.19	"	14.3.21	T22	6/9
E. M.	52	F	L	Chronic	6/5	Tn	5.9.19	"	19.1.21	Tn	6/9
S. S.	57	M	L	Acute	Fingers	T+2	27.9.19	"	26.6.20	Tn	6/12
M. P.	64	F	R	Acute	—	T+1	27.9.19	Iridy.	22.11.19	Tn	6/18
"	"	"	L	Acute	P. of L.	T+1	20.9.19	Holth	22.11.19	Tn	6/24
E. S.	47	F	R	Acute	Fingers	T+1	18.10.19	"	26.11.19	Tn	—
J. S.	77	M	L	Chronic	6/12	T+?	25.12.19	"	30.6.20	T+?	6/18 pt.
J. Y.	85	M	R	Chronic	6/18	Tn	18.2.20	"	14.7.20	T—	6/18
"	"	"	L	Chronic	6/12	Tn	25.2.20	"	14.7.20	T+?	6/20
S. G.	65	F	R	Chronic	Fingers	T+1	10.3.20	"	2.10.20	Tn	Fingers
"	"	"	L	Chronic	6/9	T+?	17.3.20	"	2.10.20	Tn	6/9
J. F.	74	M	L	Chronic	6/9	T+?	31.3.20	"	30.6.20	T—	6/12
S. G.	63	F	R	Chronic	6/24	T+1	7.4.20	"	10.8.21	T20	6/24
"	"	"	L	Chronic	6/6 pt.	T+1	14.4.20	"	10.8.21	T32	6/5 pt.
J. T.	64	F	R	Chronic	Fingers	T+?	5.5.20	Elliot	20.10.20	T35	H.M.
"	"	"	L	Chronic	6/36 pt.	T+?	27.4.20	"	20.10.20	T16	6/36
G. A.	56	M	L	Acute	—	T70	25.7.20	Holth	2.7.21	T30	6/9
J. R.	56	M	L	Acute	—	T+2	25.8.20	"	19.3.21	T25	6/5
G. H.	58	M	R	Acute	3/60	T+	28.8.20	Iridy.	11.9.20	T19	6/6
M. H.	70	F	L	Chronic	6/60	Tn	1.9.20	Holth	16.10.20	T21	6/36
W. S.	39	M	R	Subacute	6/18	T+2	8.9.20	"	21.5.21	Tn	6/9
J. F.	63	M	R	Acute	Shadows	T95	26.9.20	"	15.10.21	T40	H.M.
M. H.	63	F	L	Chronic	6/36	T50	16.10.20	"	1.6.21	T60	6/36
J. T.	62	M	R	Chronic	6/9	T48	24.11.20	"	8.1.21	T33	6/9
J. M.	61	M	R	Chronic	6/36	T80	27.11.20	"	29.10.21	T46	6/18 pt.
H. B.	58	M	R	Acute	5/60	T80	27.11.20	"	23.7.21	T30	6/12
"	"	"	L	Acute	—	T+3	2.12.20	Lagrange	"	T19	6/12
J. D.	70	M	L	Chronic	6/36	T45	4.12.20	"	27.7.21	T32	6/36
"	"	"	R	Chronic	6/36	T50	9.2.21	"	"	T40	6/36
C. S.	46	F	L	Subacute	6/60	T80	2.2.21	"	9.3.21	T—	6/12
M. W.	56	F	R	Subacute	6/36	T75	23.3.21	Holth	23.7.21	T45	6/12
C. D.	39	F	R	Chronic	6/12	T70	23.4.21	"	29.6.21	T24	6/9
"	"	"	L	Chronic	6/18	T35	8.6.21	"	"	T28	6/9
A. H.	63	F	L	Acute	—	T+3	27.7.21	"	13.8.21	T30	6/12

Of the 35 eyes, 11 had acute glaucoma, and 24 subacute or chronic. In all those with acute glaucoma, the tension was reduced to normal and the vision improved. In the chronic cases, so far as they have been followed, the glaucoma was arrested in all but 3.

SUMMARY.

Glaucoma, left to itself, ends in blindness. Primary glaucoma affects both eyes. Medical treatment of primary glaucoma should be relied upon only in a few carefully selected cases, the patients being kept under close observation. In acute glaucoma, iridectomy performed early almost invariably relieves the symptoms, the cure being permanent in more than half the cases, the remainder requiring some form of filtering operation, either combined with the iridectomy or subsequently. In chronic glaucoma, the newer operations produce permanent relief of tension and conserve vision in the majority of cases; the proportion of cures is likely to increase with improved technique. The incidence of 'late infection' is probably less than 1 per cent, and it is likely to disappear with improvement in technique. There are a very few cases in which, although hypertension has been relieved, vision steadily falls off until the eye becomes blind. These cases should become rarer with earlier operation, and with increased use of the tonometer to detect slight rises of tension. The earlier a case of glaucoma receives efficient treatment, the better the prognosis. In early cases, the visual acuity after

operation is as good, or nearly as good, as before operation. Vision already lost by optic nerve atrophy is not regained by operation; the best possible result is the maintenance of the vision remaining.

REFERENCES.—¹Lawson, "A Case of Glaucoma Simplex Treated for Thirteen Years without Operation", *Trans. Ophthalmol. Soc.* 1913, xxxiii, 194; ²Herbert, *Brit. Jour. Ophthalmol.* 1920, May, 222; ³Von Graefe, *Arch. f. Ophthalmol.* 1857; ⁴Sulzer, *Ann. d'Oculist.* 1901, cxxv, 437; ⁵Vettiger, *Ibid.* cxxvi, 484; ⁶Lagrange, *Rev. gén. d'Ophthalmol.*, 1906, and *Arch. d'Ophthalmol.* 1906, August; ⁷Holth, *Ann. d'Oculist.* 1909, cxlii, July, 1; ⁸Elliot, *Ophthalmoscope*, 1909, Dec., 804; ⁹Elliot, *Glaucoma*; ¹⁰Morax et Fourrière, "Résultats éloignés de la Sclérecto-iridectomie dans la Pratique hospitalière," *Arch. d'Ophthalmol.* 1921, Juillet, 435; ¹¹Morax, "Résultats éloignés de la Sclérecto-iridectomie dans la Pratique privée," *Ibid.*

Arthur D. Griffith.

GLYCOSURIA.—(See DIABETES MELLITUS.)

GOITRE.—Swellings of the thyroid gland may be due to a variety of causes, of which the following are the most important: (1) *Parenchymatous goitre*; (2) *Adenomatous and cystic goitre*; (3) *Papilliferous goitre*; (4) *Malignant goitre*; (5) *Exophthalmic goitre*.

1. **Parenchymatous Goitre** usually attacks older children or young adults, advances to a certain extent, and then becomes stationary for the rest of the patient's life. Not uncommonly, however, it may resume growth and produce marked pressure symptoms, even in adults. Sometimes a goitre appears rapidly and increases at a great rate, causing considerable dyspnœa.

2. **Adenomatous and Cystic Goitre** do not usually show the same tendency to arrest, but very gradually increase in size. Hæmorrhage into a cyst may bring on urgent dyspnœa.

The prognosis as regards life in these three conditions is almost always favourable. Suffocation from pressure on the trachea only in quite rare cases comes on so rapidly as to be dangerous. Apart from operation, of course, some patients would pass gradually into a very grave condition from lateral compression of the air-passages. A few simple goitres in elderly persons assume malignant characters.

Spontaneous cure is not to be hoped for, except in quite recent cases in young adults or children. Iodides or thyroid extract will aid in bringing this about, but if the swelling has persisted many months they usually fail. If they are going to do any good, the benefit will be evident within a month. It is often desirable to change the supply of drinking water or boil the water.

In rare cases of goitre the internal secretion of the thyroid becomes deficient, and myxœdema ensues. More commonly it is excessive, with mild symptoms of Graves' disease.

The children of goitrous mothers suffering from deficient thyroid secretion are apt to be goitrous. Congenital swelling of the thyroid is almost invariably associated with goitre in the mother, and the child may be a cretin. In the great majority of cases of goitre in women there is no thyroid insufficiency, and the children are therefore normal.

The prognosis after treatment by operation is very favourable. Only a small proportion of cases of goitre need be operated on, marked deformity or dyspnœa being the principal indications, and "there is never too much dyspnœa" for the operation to be done (Berry).

The operation mortality is very low. At the Bristol Royal Infirmary during the past three and a half years, 59 operations have been done without a death. Kocher's mortality is 3 in 1000. Of 267 innocent cases, Berry lost 3, 2 dying of heart failure and 1 of pleurisy following a wound of the larynx. In a further series of 408 cases, he lost two. A general anæsthetic, usually open ether, was used. None of his cases developed tetany or myxœdema, which in the early days, when all or nearly all the thyroid gland was removed, were both fairly frequent. Tetany is not entirely banished, however, as a number of modern operators have been less fortunate than Mr. Berry, and can report a case or two. It appears to be due to removal of the principal functioning parathyroid gland lying behind the thyroid. It is not usually very serious, even if it does occur. There is a risk, small but not negligible, of death from hæmorrhage; I have seen one case.

The *end-results*, provided an adequate removal is made, are most satisfactory. In Mr. Berry's tables, 222 out of 274 are perfectly cured as far as the goitre is concerned (traced from one to five years, very few less than one year). In two cases the growth, though innocent, is extending, and in one stridor persists. The others are either lost sight

of, or some swelling remains. In Berry's recent series of 408 cases, 3 had an injury of the recurrent laryngeal nerve; 342 were quite well, and in 30 other cases their subsequent troubles were not connected with the goitre. In 18 cases the operation was not wholly satisfactory.

3. Papilliferous Goitre is by no means so favourable in prognosis. It is not a malignant growth, but there is a considerable tendency to recurrence. Five patients came under Mr. Berry's care; 1 is lost sight of, and 2 were cured, but in 2 others the growth continued enlarging and they returned for operation after operation for several years.

4. Malignant Goitre is uncommon, and the prognosis is very grave indeed, both as regards the immediate and the ultimate results. It invades the larynx and its nerves early, and causes secondary glands in the neck. Of 7 cases in Mr. Berry's statistics, 3 died after the operation, 1 is lost sight of, and the other 3 died of recurrence twelve, fourteen, and sixteen months later. His later series shows one or two successes.

Balfour, in reporting 103 cases from the Mayo clinic, points out that in nearly half the patients the malignancy was not suspected before operation, which was undertaken for a supposed innocent adenoma. Of these cases, 70 per cent remained free from recurrence. When malignancy had been recognized before operation on account of the hardness and rapidity of growth, very few of the patients were cured. This is a strong argument for removing all adenomatous goitres.

5. Exophthalmic Goitre.—This is discussed elsewhere (*see* EXOPHTHALMIC GOITRE).

REFERENCES.—Berry, *Proc. Roy. Soc. Med. (Surg. Sect.)*, 1908 i, pt. 3, 21; Balfour, *Med. Record*, 1918, xlv, 846; Berry, *Brit. Jour. Surg.* 1921, April, 413.

A. Rendle Short.

GONORRHOEA IN THE FEMALE.—Since the incidence of gonorrhœa in women cannot be estimated or even guessed, it is impossible to say in what proportion of cases serious ill-effects develop. Considering the well-known prevalence of gonorrhœa in men, and the fact that a very high proportion are inadequately treated, it might be inferred that a very high proportion of women who indulge in sexual intercourse must contract the disease. Yet in proportion to men the numbers attending British Venereal Disease Treatment Centres is very low. Thus, in 1920 the numbers of new cases of gonorrhœa were 6474 women to 33,810 men, a proportion of one to five. Moreover, there is some reason for believing that less than half the cases of gonorrhœa in males of what may be called the clinic class actually do attend the clinics. Thus, judging by the Army statistics, gonorrhœa is over twice as prevalent as syphilis in men, and this estimate is supported by the statistics of notified cases in Sweden and Denmark, where the numbers per 10,000 of the population in 1920 showed, for Stockholm, 109 gonorrhœa to 24 syphilis; for Sweden generally, 25.6 gonorrhœa to 6.3 syphilis; and for Denmark, 131 gonorrhœa to 52 syphilis. Yet in England and Wales the male gonorrhœa cases (33,810) were only slightly over the male syphilis (28,799), and the female gonorrhœa (6474) were less than half the female syphilis. If we may assume that gonorrhœa in women bears somewhat the same proportion to syphilis that it does in men, with the knowledge that a high percentage of syphilis in women goes unrecognized, these figures suggest strongly that, in the great majority of women, gonorrhœa does not give rise to symptoms which compel resort to a doctor.

It is, of course, well known that gonorrhœa in women is responsible for a very high proportion of the pelvic disease which gives so much work to gynæcologists, but this is no indication of the chances of an individual female suffering from gonorrhœa developing such complications.

The prognosis in female gonorrhœa may be considered from the point of view of each of the canals which may become infected.

Urethritis is usually mild in women and very rarely leads to stricture. It yields fairly readily to treatment by irrigation, and almost the only trouble arises from infection of Skene's ducts, in which the disease may persist until the duct has been destroyed by cauterization.

Infection of one or both Bartholin's Ducts and Glands with abscess formation is not very common, but a chronic infection may easily be overlooked. It often gives rise to such slight signs only as redness of the duct orifice, from which a little pus may possibly be squeezed, and unless treated may continue to be a source of infection for many years. The inflammation may yield to injections into the duct of strong silver

nitrate solution, but many workers prefer to dissect out the whole gland and duct under a general anæsthetic. This is indicated where there is chronic enlargement of the gland which does not yield to milder measures. If an acute abscess forms, a free incision through the mucous surface of the labium usually clears up the infection, as the cavity can then heal from the bottom. Better results are claimed for complete enucleation before the abscess has burst.

Gonorrhœal Vulvo-vaginitis of adults is troublesome, as a rule, only in the early stages of gonorrhœa in women. In this it contrasts with the vulvo-vaginitis of little girls, which is usually gonococcal in origin. It may necessitate confinement to bed for some days, during which any treatment of the cervix is precluded. *Vulvo-vaginitis of little girls* is a particularly troublesome complaint, though the infection is believed usually to remain confined to the vulvo-vagina. In most cases of vulvo-vaginitis the infection persists for many months. Hamilton and Cook¹ believe that better results follow vaccine treatment than local, and that cases often do better on vaccines alone than vaccines and local treatment. Other workers have not expressed such a favourable opinion of the results of vaccine treatment. Vulvo-vaginitis is a definite danger to other children, and may become a source of great trouble in an institution from the infection spreading rapidly to all the children.

As a result of irritation by the abundant discharge, numerous warts may cover the labial surfaces. Gonorrhœal warts, so called, may prove very persistent, but commonly yield to drying applications and such medicaments as resorcin ointment or a mixture of salicylic and acetic acids.

Cervicitis is so common in the gonorrhœa of adults as to be almost the rule. On account, also, of the rich glandular supply of the cervix, gonorrhœa in this situation is difficult to eradicate. The writer has frequently heard the opinion expressed by experienced gynæcologists that gonorrhœal cervicitis is incurable. Many facts suggest that such a view is unduly pessimistic. It is true that in a very large number of cases a cervical discharge persists; many cases, too, relapse, with gonococci in the discharge, after a cure appears to have been attained; or, without any marked return of discharge, the patient may infect some man. But every cervical discharge is not necessarily gonococcal, though it may have commenced as such. Microscopical specimens of the secretion of such cases often teem with secondary organisms—diphtheroids, staphylococci, and streptococci—which we know from experience in men often cause a persistent gleet. Secondary organisms are all that may be discovered also by repeated culture of the cervical secretion on such a culture medium as Thomson's, on which gonococci grow profusely, and the complement-fixation reaction with a gonococcal antigen is negative. Without the further tests which have been mentioned, such cases as these are diagnosed as still suffering from gonorrhœa, and there is small wonder that, considering their large numbers, the clinician who does not trust or employ bacteriological help is pessimistic. Considering the comparative rarity with which newly-married husbands of widows seek advice for gonorrhœa commencing soon after marriage, to believe that gonorrhœa in women is incurable it is necessary to assume either that few men infect their wives, or that, after infection, these become non-contagious—with gonococci still present in the genital discharges! The considerations mentioned above, and the knowledge that gonorrhœa in women is, for the most part, inadequately treated, have made me strongly inclined to believe that, in the majority of cases, the infection is self-limited, being brought to an end by the natural resistance of the patient. At the same time it must be recognized that a proportion of patients remain gonococcal carriers just as do a proportion of sufferers from other infections—typhoid fever, for example.

The Body of the Uterus is found to be infected in many cases in which gonococci persist, and drainage by the method advocated by Hobbs² has given good results in the hands of Mr. Anwyl Davies at St. Thomas's Hospital. The cervix is dilated just sufficiently to admit a No. 3 (English) soft catheter, and the uterus gently syringed out with tinct. iodi and glycerin, after which the catheter is allowed to remain within the uterus for six or eight hours. In many cases the operation can be done without an anæsthetic, though the syringing and the presence of the catheter within the uterus may cause some pain, which is alleviated by aspirin and bromide.

After reviewing the innumerable methods of treating gonorrhœa in women which

had been tested at St. Thomas's Hospital, the writer determined to try the effect of eliminating all caustic treatment and of aiming solely to promote drainage. Caustic treatment is designed to reach down to and kill gonococci in the depths of the cervix; it usually fails to kill the gonococci, and does result in a slough of the cervical mucosa, in which secondary organisms find an ideal culture medium. The drainage method, as it might be called, which was instituted, consisted in the regular irrigation of the urethra and the cervix with mild antiseptics, followed by the application to the cervix and vagina of a variety of antiseptic glycerins on which the changes are rung. At the same time the patient's resistance is raised by the regular administration of vaccines, or by intravenous injections of electrargol, as recently again advocated by Graebke. The results have been considerably better, and have certainly justified the change of method, though it cannot yet be claimed that the disease is an easy one to treat. It requires meticulous attention to detail, and the more the intermediate treatment can be carried out by a nurse, the better the result.

Fallopian Tubes, Ovary, and Peritoneum.—In what proportion of cases these structures become infected it is impossible to say; but in spite of the large number of pelvic operations carried out every year for the results of gonococcal infection of the uterine adnexa, the proportion which these bear to the whole number of cases must be a very small one. In the St. Thomas's Hospital clinic, from Jan. 1, 1920, to June 30, 1921, there were treated 525 cases of gonorrhœa in females, a large proportion of whom have attended very faithfully; out of these none was operated upon for salpingitis. On the other hand, it is a comparatively frequent occurrence for one or both tubes to be found enlarged and tender, while the patient suffers from backache, pain, anæmia, and menstrual disorders. Thus, in a series of 175 cases examined by Dr. A. Davies, 31 were found to have some degree of salpingitis. In some cases the enlargement has been considerable, but all have resolved gradually under local treatment applied to the cervix and possibly to the uterine mucosa. A good example of the effect of uterine drainage is related by Hobbs; the right tube was enlarged to the size of a Tangerine orange, but gradually subsided under this method of treatment. Even in cases running a high temperature and with indications of pelvic peritonitis, conservative treatment designed to secure drainage from the uterus very frequently succeeds in securing relief; and the same applies to cases of chronic endometritis with continual backache and depression. Altogether my experience, and that of my colleagues, inclines me strongly to the belief that abdominal operations for gonorrhœal inflammation of the uterine adnexa are necessary in only a very low proportion of cases. Naturally an acute pyosalpinx may burst or pour its pus through the abdominal ostium, and require immediate operation. Also, disabilities resulting from adhesions, the consequence of gonococcal infection of the tubes, ovaries, or pelvic peritoneum, may be relieved only by operation; but in proportion to the huge numbers of gonorrhœal women the numbers must be very small.

Gonorrhœal Proctitis is more common in women than men.

Metastatic Complications are of the same general nature as in males, but their incidence does not appear to be so great.

Gonorrhœa and Sterility.—Gonorrhœa is an important cause of sterility. Vaginal discharges may be strongly inimical to spermatozoa; the cervical changes and blockage of the canal by inflammatory secretion may present an impassable barrier to spermatozoa; and completely or partially blocked Fallopian tubes may prevent the passage of the ovum to the uterus and so produce complete sterility, or arrest the fertilized ovum and be a cause of ectopic gestation. Admitting all these possibilities, a careful consideration of all the available facts leads one to conclude that either gonorrhœa is not so prevalent as is generally believed, or it does not cause sterility in any but a low proportion of cases. This is not meant to deny that gonorrhœa prevents annually the birth of a very large number of infants. Giles³ quotes various authors who estimate the proportion of sterility from all causes in the general population at 2 to 20·5 per cent. Amongst these are Simpson, who found 10·9 per cent in two villages and 16·3 per cent in 503 aristocratic families; and Duncan, 15 per cent of 4372 marriages in Edinburgh and Glasgow. Giles's own private records, which are free from the error of omitting miscarriages and stillbirths, showed 31·0 per cent of 678 women age 29 and under; 23·8 per cent of 1284 age 30 to 39; 15·3 per cent of 1166 age 40 and over; and 22·2 per cent of the 3128 married

women of all ages. Thus the group which had had the greatest chance of pregnancy had 15.3 per cent of sterility. These figures are based on patients, and some reduction would be likely from an investigation of the general population. Giles estimates the proportion of sterile marriages in this country at well below 15 per cent, and believes that Simpson's estimate of 10 per cent amongst the working classes and 16 per cent amongst the leisured is nearest the truth. The question arises, what proportion of these is due to gonorrhœa in women? Only a roughly approximate estimate is possible. In Giles's analysis, 10 per cent had endometritis and vaginitis; 10.9 per cent tubal disease; 4.4 per cent peritonitis; and in the balance the sterility was not attributable to gonorrhœa. If it were assumed that 90 per cent of the above endometritis, salpingitis, and peritonitis was gonococcal, a figure which is probably well over the mark, roughly 22 per cent of all sterility would be attributable to this disease. Assuming that less than 15 per cent of all marriages are sterile, the calculation makes gonorrhœa responsible for roughly 3 per cent of marriages being sterile. Giles, taking 10 per cent as a minimum of sterile marriages and 20 per cent of these due to female gonorrhœa, estimates the total sterility due to pelvic inflammation, of which gonorrhœa is the main cause, at 2 per cent of marriages. He quotes Lier and Ascher's estimate of 13 per cent and Pincus's of 15 per cent of all sterility due to gonorrhœa, and considers that Noegerrath greatly exaggerated in attributing 90 per cent of sterility to gonorrhœa in both sexes. As to the absolute effect on the population, Giles estimates, on a normal expectation of 3 children for every fruitful marriage and an average of 333,500 marriages a year, that pelvic inflammation causes the chance to be lost of 20,000 children a year being added to the population. McDonald⁴ states that pregnancy frequently occurs in tubal inflammation unless the tubes are tightly bound down. Though admitting that gonococcal infection of the tube is a frequent cause of sterility, this author holds that Lier and Ascher's estimate of 13 per cent due to gonorrhœa is much exaggerated. He quotes Bumm's statement that nearly a fifth of the women delivered again and again in the maternity clinic suffer from chronic gonorrhœa, while Stone and McDonald,⁵ investigating gonococcal infection in the puerperium, found a large percentage suffering from this disease. McDonald holds that gonococcal infection is a much more common cause of one-child sterility, the puerperium having opened the way for the gonococcus to infect the tubes.

Gonorrhœa is an important cause of puerperal sepsis and subsequent endometritis, salpingitis, or pelvic peritonitis, either through purely gonococcal infection or infection by secondary organisms for which gonorrhœa prepared the ground. Giles found that pelvic inflammation was responsible for one-child sterility in 77 cases out of 246 analyzed, and for two-child sterility in 47 out of 153 cases. Naturally all these cannot be attributed to gonorrhœa, since puerperal sepsis may be due to other causes. On the other hand, gonorrhœa contracted after the first normal birth and puerperium may be a cause of pelvic inflammation and subsequent sterility.

The prospects of remedying sterility following gonorrhœa depend naturally on the part affected. Double salpingitis presents a mechanical obstacle which offers little hope of remedy, though salpingostomy to open out again the occluded outer end may occasionally result in restoration of the patency of the tubes. Sterility from endometritis is naturally much more amenable to treatment. Giles records that, in the cases operated on by him for pelvic inflammation, 25 per cent subsequently became pregnant, and Morris gives the same proportion of successes.

It is natural to reflect that much of the sterility, and indeed much of the suffering due to gonorrhœa, is preventable; but the reflection appears generally to stop at ways and means of preventing gonorrhœa. Perhaps some thought on the means of preventing the sequelæ of gonorrhœa might be of more immediate profit. A knowledge of the treatment usually administered to a female suffering from gonorrhœa leaves one wondering that such a large proportion survive with very fair health. The female genital passages must have an extraordinary resistance to infection! The average case of gonorrhœa is ordered a lotion and told to douche at home. She is not taught how to douche, how to sterilize her apparatus, or how to prevent extraneous organisms being pushed into the vaginal canal. Yet a moment's reflection would convince the prescriber that he is only adding fuel to fire by telling an ignorant woman to introduce solutions into her vagina with a douche-can which starts its life of utility contaminated with packing material, and

normally resides hidden behind a bath tub amongst the dusters, or buried in a drawerful of old clothes, with its nozzle lying anywhere but in antiseptic solution. Add to this the irritant effect of most solutions used, with their very slight sterilizing effect on the vaginal flora, and it is not difficult to see why so many women suffer from chronic cervicitis and vaginitis due to other organisms than the gonococcus. Not the least hopeful means of reducing the present aggregate of invalidism from gonorrhœa is the reform of intermediate treatment on lines which are designed to prevent, as far as possible, secondary infection.

REFERENCES.—¹*Jour. of Infect. Dis.* 1908, v, 152; ²*Practitioner*, 1921, Jan., 31; ³*Sterility in Women*, Oxford Med. Publications; ⁴*N.Y. Med. Jour.* 1911, Dec. 23, 1265; ⁵*Surg. Gynecol. and Obst.* 1906, Feb.

L. W. Harrison.

GONORRHOEA IN THE MALE.—The prospects of aborting gonorrhœa are good if treatment is commenced on the very first day, before the gonococcus has penetrated to the deeper layers of the mucosa. After this the chances of success diminish rapidly, and by the time the discharge has become frankly purulent they have practically vanished. The results obtained at the prophylactic stations established by the Australian Forces in England during the war may be quoted in illustration¹ :—

Of men reporting within 8 hours of appearance of discharge, 96 per cent of successes

"	"	"	8-12	"	"	"	86	"	"
"	"	"	12-24	"	"	"	86	"	"
"	"	"	over 24	"	"	"	60	"	"

At Rochester Row the success was not so great, about 30 per cent, probably because in a large proportion of the cases abortion was attempted after the discharge had become purulent. The discharge should be examined on the third day of the treatment, and if it is found to contain gonococci, the prospects of success are slight. If gonococci persist to the fifth day, it is better to pass on to the ordinary lines of treatment.

Comparison of Different Forms of Abortive Treatment.—Quite as good results are obtained by simple washing out of the canal with potassium permanganate, followed by injection of an organic silver preparation, which is retained for some minutes, as by more heroic measures, such as packing with gauze soaked in an organic silver preparation, Ballenger's sealed-in treatment, or painting the whole canal with strong silver nitrate solution. The simple method has the advantage that, if the attempt at abortion fails, the patient is no worse off, which cannot be said of those forms of treatment which seriously damage the mucosa in the attempt to destroy the gonococcus out-of-hand.

When abortive treatment has failed, or the patient is already beyond the stage at which it is practicable, the prospects depend on: (1) The patient's natural resistance; (2) The age of the infection; (3) The treatment applied.

1. The Patient's Natural Resistance.—This is a factor of the greatest importance. I have seen many cases of gonorrhœa clear up completely in a week or ten days under treatment which was not particularly skilled; and, on the other hand, I have seen many drag on for months, discharging pus containing multitudes of gonococci, under the most careful treatment. Generally it has seemed to me that the patient who reacts violently (and reaction is surely a defensive measure) clears up completely in a much greater proportion of cases than the one whose attack is manifested by mild urethral symptoms. The latter type of patient is often only made aware of the fact that he is suffering from gonorrhœa by the development of such a complication as epididymitis or arthritis, and these cases are particularly difficult to clear up. The patient's resistance is a factor which is often forgotten, but since no drug applied locally can reach down to and destroy the gonococcus in the depths to which it can penetrate, it is clear that, without it, the surgeon is practically helpless. The moral is that not the least important part of treatment is that directed to maintenance of the patient's health in the best possible state.

2. The Age of the Infection.—Much depends on whether the disease has passed to the posterior urethra, as it is believed to do in about 80 per cent of untreated cases in the second week. If the posterior urethra has not become infected, it can usually be saved if everything can be sacrificed to treatment. Unfortunately, gonorrhœa is a disease which a patient has a natural instinct to conceal, and most patients either arrive with the disease well established in the posterior urethra, or their circumstances so interfere

with the full application of treatment that posterior urethritis supervenes, with the possibilities of complications mentioned below. Assuming the disease to remain confined to the anterior urethra, the only complications which need be feared are peri-urethral infiltrates, possibly with abscess formation, and cowperitis.

Peri-urethral infiltrates of a size which can be detected easily by palpation are uncommon. Very rarely they break down, with abscess formation, and may discharge through the skin. Much more often they gradually subside, but may fail to clear up completely. In this case they may lead to stricture formation at a later date. Stricture requiring surgical interference must be an extremely uncommon sequel of gonorrhœa, considering the enormous prevalence of the latter disease. Much more commonly peri-urethral infiltrate is a cause of repeated relapse, unless the cure is completed by full dilatation of the canal, as the small collection of infective material in it alternately gathers and is discharged on the urethral surface.

Cowperitis is a rare complication of gonorrhœa. In my experience it has usually occurred in old cases with some stricture formation in the urethra distal to the duct openings: these had no doubt been 'blown' by the back pressure.

Invasion of the posterior urethra gives rise to the possibility of cystitis, prostatitis, vesiculitis, epididymitis, and metastatic complications, of which the most important are arthritis, bursitis, tenosynovitis, iritis, and endocarditis.

Gonococcal cystitis is usually confined to the neck of the bladder, and clears up under the treatment applied to the posterior urethra. Some degree of *prostatitis* probably occurs in most cases of posterior urethritis, but the complication is most frequently discovered only by objective examination. Prostatic abscess is an uncommon sequel, occurring in less than a quarter per cent of cases. It usually bursts into the posterior urethra after about a week; much less commonly it opens into the rectum, and extremely rarely tracks into surrounding tissues. Though a troublesome complication, it is one which is very rarely a cause of real anxiety. A quiet prostatic abscess, due to staphylococcal or streptococcal infection, may form a number of years after an attack of gonorrhœa and, bursting into the urethra with hardly any premonitory symptoms, may alarm the patient considerably because of the outpouring of discharge from the urethra.

Acute vesiculitis is uncommon, but the chronic form is often associated with chronic prostatitis, and is one of the great causes of chronicity in gonorrhœa. Metastatic complications also seem in most cases to depend on the focus of infection in prostate or vesicles, or both, and an important section of their treatment consists in clearing up the prostatic and vesicular infection.

The course of posterior urethritis is usually dependent on chronic prostatitis; but, apart from the persistence of infection in the prostate, the mucosa may remain diseased, with infiltrates, granulation tissue, and polypi which require local applications. Secondary infection often keeps up a urethritis, and is doubtless responsible for the threads which persist in the urine of many patients for years after the gonococcus has disappeared.

Epididymitis varies enormously in its incidence, and undoubtedly depends very largely on treatment. In Army cases during the war it was about 17 per cent, but the majority of cases were admitted with the complication. The incidence in cases admitted without epididymitis varied from 2 to 7 or more per cent. The former prevailed in hospitals where the life was more or less sedentary, and the medical officers were careful not to interfere too early with sounds, prostatic massage, instillation of strong chemicals, and so forth. The higher percentages occurred in hospitals where the patients were put on heavy fatigues, or were allowed to play football, and where enthusiastic medical officers practised strong measures in the acute stages of the disease. Double epididymitis is relatively rare. Ordinarily it means sterility, but Paul Asch claims to have restored the patency of the canal by injecting electrargol into the epididymis. Probably the operation resulted in the establishment of a short circuit. Failing restoration of the communication between the vas and testicle by the above method, an anastomosis may be effected between the head of the epididymis and the vas deferens. This results in about 50 per cent of successes.

Gonococcal arthritis, with tenosynovitis and bursitis, occurred in 1 to 2 per cent of one series of about 2500 cases which I analyzed. Lumb, in a later analysis of 50,000 cases in the same hospital, found that 0.5 per cent had suffered from arthritis. The joints most

commonly affected are the knee, ankle, wrist, tarsus, fingers, elbow, and temporomaxillary, in approximate order of frequency, but any other may suffer. It is common for two or more joints to be affected, and neighbouring bursæ and tendon sheaths are often involved. Suppuration is extremely rare, but the course is usually long and tedious, and considerable crippling is apt to result from adhesions and from osteo-arthritic changes in the articular surfaces. The most troublesome cases of this kind are those in which the tarsus is affected: flat-foot is a common result, and the patient may become permanently lame. Arthritis associated with keratoderma is usually severe, and I have seen a patient suffering from keratoderma with so many joints affected that he could hardly be moved in bed. After lying for many months in a helpless condition, he began to die of hypostatic pneumonia, when a series of intramuscular injections of neosalvarsan was instituted, and this resulted in his complete recovery.

Iritis, with metastatic conjunctivitis, occurs in less than 0.25 per cent of cases. It is very apt to recur unless the infecting focus, usually in prostate or vesicles, is cleared out. The chief danger is from adhesions, which must be prevented by the early use of atropine.

Endocarditis is very rare. At least it is very rarely diagnosed. The fatal ulcerative form, judging from British Army experience during the war, does not occur more often than once in about 100,000 cases. In the two cases seen by the writer, death was due to rupture of an aortic valve. In other cases recorded in the literature, death followed rupture of aortic valve, embolism, septic intoxication, and nephritis. More than half the recorded cases have died.

3. Effects of Treatment.—To a casual observer, one form of treatment of male gonorrhœa appears to be as good as another, and none particularly good. The writer has frequently been informed by his superior officers that "we got just as good results in the old days with a syringe as you do to-day with your modern treatment: the patients were discharged from hospital in about six weeks, and that is rather shorter than you take over an average case these days". It is true that the patients were discharged in less time than the average of about forty-seven days which prevailed during the war; but it was on their bare *statement* that there was no more urethral discharge, and without any objective examination to determine whether or not the disease had really gone. Judged by objective tests, the old syringe treatment failed lamentably, and, apart from the higher relapse rate which resulted, it is improbable that it did much towards stopping the spread of gonorrhœa by rendering patients non-infective. As to the value of local treatment, Donald and Davidson² compared the progress of 200 cases of purely medicinal treatment with that of average cases of irrigation with potassium permanganate, and found that, in regard to cessation of discharge and proportion of complications, the irrigated cases did far better. This agrees with an earlier observation of the writer's. During the war I had the opportunity of observing the work of many medical officers treating gonorrhœa, and comparing their results in very large numbers of cases. I found a very wide difference between those where the officer had attended to small details, and those where he had blindly followed some routine. Generally, it pays not to interfere with sounds, prostatic massage, or the introduction of strong chemicals into the urethra, until the urine has become clear, and meticulous care to prevent secondary infection saves many days of treatment after the gonococcus has disappeared.

The routine treatment of ordinary gonorrhœal urethritis by vaccines, especially those made by Thomson's method, has been shown in the parallel series of cases reported by Lees,³ and by Corbett and Osmond,⁴ to result in quicker recovery. Other workers, including the writer, have found that gonorrhœa treated by vaccines from the first pursues a milder course with fewer complications than when vaccine is omitted. The good results of vaccine treatment of complications are admitted almost universally. Perhaps quicker relief follows what is known as protein-shock therapy, which consists in the intramuscular or intravenous injection of a variety of substances. Amongst others which have been employed are antityphoid vaccine, 150 to 200 million intravenously; electargol, 2 to 10 c.c. intravenously; milk, 10 c.c. intramuscularly; and intramine, 2.5 to 5 c.c. intramuscularly. There is no question that the outlook for a case of gonococcal arthritis has been immensely brightened by the introduction of this form of treatment. In the light of the brilliant results of the protein-shock therapy, it is difficult to say in

which category should be placed the intravenous injection of gonococcal vaccine which Bruck advocated in 1913 as preferable to the subcutaneous injection.

In the severe case of keratoderma blennorrhagica which has been mentioned above, the subcutaneous injection of neosalvarsan, suggested by Professor R. Bolam on the strength of its effect in a similar case, undoubtedly saved the patient's life. In this connection it may be mentioned that Lévy-Bing⁵ and Doble⁶ have reported brilliant results in epididymitis from the intravenous injection of sulfarsenol.

Gonorrhœal Ophthalmia occurred in about one per thousand cases of gonorrhœa amongst British soldiers during the war. The outlook depends very largely on treatment, which should be commenced as early as possible and be carried out with meticulous care to prevent accumulation of secretion in the conjunctival sac.

Ophthalmia Neonatorum.—Harman⁷ calculated from an analysis of the vision-testing returns of 412,527 London school children, and from examination of children in the London County blind schools, that one school child in 4400 suffered permanent damage or was blind from ophthalmia neonatorum. From his hospital case-records, he finds that no more than 31 per cent of all cases of ophthalmia neonatorum brought to hospital suffer permanent effects. This is a high rate of permanent damage, and probably attributable to the fact that slight cases were not taken to hospital, as is shown below. Going further back to infancy, Harman found in 12,680 births that 0·87 per cent had suffered from purulent conjunctivitis, and in 6 out of the 100 cases represented by this percentage the cornea was damaged, i.e., in 0·047 of the births. This compares with 0·0226 per cent of 790,000 school children who showed evidence of damage from ophthalmia. He attributes the difference to the higher mortality of infants born of gonorrhœal mothers. The results in 3450 cases of true ophthalmia neonatorum treated in Manchester⁸ during nine years showed 7 totally blinded; 20 with one eye lost (of which 4 had the other eye damaged); 6 with both eyes damaged; 8 with one eye damaged; and 57 deaths before recovery. The notified cases of ophthalmia neonatorum in England and Wales in 1920 were 10,304, or 13·2 per 1000 of live births. This represents an increase of over five per thousand since 1915, which may be attributable partly to better notification and partly to an increase in gonorrhœa amongst the general population.

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L. W. Harrison.

GOUT.

Acute Gout.—The danger to life in an acute attack is practically negligible, unless acute inflammatory changes are set up in internal organs as a result of chill or injudicious treatment of the articular lesion. Violent cerebral, gastric, or cardiac symptoms may be set up in this way, and then the immediate outlook becomes grave indeed. The predominant symptoms indicating these changes are severe headache, violent delirium, acute epigastric pain associated with obstinate vomiting, and signs of acute pericarditis with a rapid, intermittent pulse and a tendency to syncope. The prognosis is worse if there is a strong hereditary history, and if the attack occurs early in life.

Chronic Gout.—As a rule, in this condition the main danger lies in the gradual onset of complications, the most important of which are in the renal and cardiovascular systems. Of the former, the contracted gouty granular kidney has to be considered. The prognosis in this is probably much the same whether it is produced by the gouty diathesis or by any other etiological factor. It leads to death mainly along three lines, viz., firstly, by cardiovascular change; secondly, by the incidence of superadded, often terminal, infections; and thirdly, by uræmic manifestations. From an analysis made by the writer from post-mortem hospital records of 156 consecutive cases of patients who died with chronic interstitial nephritis, the following figures showing the causes of death were obtained: uræmia, 21; cerebral hæmorrhage, 41; cardiac failure, 14; cardiac failure associated with much bronchitis, 7; the supervention of acute nephritis with œdema of the lungs, 2; supervention of acute nephritis with uræmia, 2; cerebral thrombosis, 4; aneurysm, 2; œdema of lungs, 2; subdural hæmorrhage, 1.

Death occurred in a large number as the result of superadded terminal infections, thus: 28 died from lobar pneumonia, 3 from bronchopneumonia, 4 from pericarditis, 4 from phthisis, 4 from empyema, 2 from general miliary tuberculosis, 1 from the combination of pericarditis, pleurisy, peritonitis, and pneumonia, 1 from pericarditis with pleurisy, 1 from pleurisy alone, and 1 each from pneumonia and empyema, pneumonia and pericarditis, and pulmonary gangrene.

The following percentages are obtained from these figures: death from uræmia, 14.7 per cent; from indirect changes in other organs, 46.2 per cent; from secondary infections, 33.3 per cent; accidental causes, e.g., carcinoma, poisons, 5.8 per cent.

The possibility of the incidence of a gouty venous thrombosis, with the occurrence of pulmonary embolism leading to a fatal result, must always be borne in mind. In spite of all these dangers, the members of a gouty family are frequently long lived.

With reference to the prognostic value of changes in the fundus, a renal retinitis has the same serious significance as in other forms of nephritis; but a unilateral hæmorrhagic retinitis, with extravasations of blood which may burst into the vitreous, sometimes occurs. These hæmorrhages are most probably due to thrombosis of the retinal vein, and do not carry the same outlook as renal retinitis.

It is yet too early to say whether the prognosis of the vascular and other lesions in gout will be materially modified by the use of radium emanations or thorium.

J. R. Charles.

GUNSHOT WOUNDS.—The time has not even yet come when definite or final conclusions can be arrived at as to the prognosis of wounds in war. We still await the official medical history of the War. Isolated statistics can be collected, but they require more than ordinary discrimination before they can be accepted at their face value, for the following reasons:—

1. Wounds vary very much in different wars. There is a desert type, and a cultivated-soil type. The first was well illustrated by the surgery of the South African War, and by the recent Senussi campaign. The second includes the surgery of the battles on the French and Belgian front, and to a less extent in the Gallipoli campaign. In the former, wounds were usually due to bullets fired at a distance, and soil infection was the exception. In the latter, owing to the conditions of trench warfare, shell and shrapnel wounds predominated, the range of bullets was often short, and soil infection from the clothes or other foreign material was the rule. Soil infection means streptococci in 80 per cent of the wounds, *B. perfringens* in at least half, and *B. tetani* in 15 per cent. Virulent streptococcal infection, gas gangrene, tetanus, and prolonged severe suppuration were therefore the rule.

2. The prognosis altered very much for the better during the course of the war, partly by improvements in medical organization, and partly by advances in surgical treatment. The turning-point was somewhere about Christmas, 1916. It is not too much to say that the difference between war surgery in 1917 and 1915 was as great as that before and after the advent of Listerism in the '70's. The principal means by which the improvement has been effected are the injection of antitetanic serum in repeated doses, excision of the wound, sterilization by the Carrel-Dakin technique or pastes (Hey's brilliant-green + boric acid + paraffin, the flavine substitute, and other paraffin methods), secondary suture, improved splinting, and more enterprising surgery. Of these no doubt the most important has been the thorough removal of devitalized muscle, so strongly advocated by Sir H. M. W. Gray. The salt pack and B.I.P.P. also served a useful purpose. Blood transfusion seems destined to play an important part in reviving sufferers from shock and hæmorrhage.

3. Prognosis is further complicated by the fact that there are three collecting places for statistics: (a) the front lines, field ambulances, and casualty clearing stations; (b) the base hospitals overseas, and (c) the base hospitals in the British Isles; but one is not complete without the other. For complete information a series of patients must be followed through all three groups. Moreover, during the war there was a steady shifting of the primary operating centre from behind forwards, the English hospitals, particularly since Christmas, 1916, getting less and less of the recent severe wounds, and the casualty clearing stations doing more and more, with great benefit to the patients, as sepsis and gas gangrene were thereby minimized, and early loss of blood reduced.

More efficient splinting between the front line and the casualty clearing station undoubtedly improved the patient's prospects, as exemplified more especially in cases of fractured femur.

4. A fourth complication is introduced by the nature of the individual wound, and concomitant circumstances. The injuries may be single or multiple, transport may be easy or infinitely difficult, the patient may come under observation early or lie out for days. Hæmorrhage varies much in similar-looking wounds. There is much difference between soldiers in their liability to shock, perhaps depending on temperament, and on previous fatigue, loss of sleep, starvation, and the psychological effects of victory or defeat.

For these reasons any conclusions must be regarded as extremely tentative. Nevertheless, a certain amount of valuable information is now available for collation.

According to a statement by Dr. Woods Hutchinson (October 1917), of wounded men who survive six hours, 90 per cent recover; of those who reach field hospitals, 95 per cent recover; of those who reach base hospitals, 98 per cent recover. Only about 5 per cent of the survivors are crippled or permanently disabled, as by amputations or other serious loss of function.

Wounds of Soft Parts.—Bullet wounds are more favourable than those inflicted by shrapnel or fragments of high-explosive shell or bombs, and if fragments of clothing are carried in, grave suppuration or gas gangrene is probable. Large retained pieces of shell almost always give trouble. Tiny smooth pieces, and undistorted bullets, do not usually cause trouble unless for mechanical reasons. Wounds of the buttock, thigh, and calf are particularly apt to give rise to gas gangrene within from one to four days if the muscles are lacerated. Everything depends on early and ruthless opening up, with thorough excision of damaged muscle until it *bleeds and contracts*. This granted, with proper antiseptic treatment, the great majority can be sutured up on the fourth day or sooner, and even wounds 10 in. long and deep down through the muscles ought to be healed in two to four weeks. The unsatisfactory cases are those in which excision is anatomically impossible (e.g., a long deep track through from the groin to the buttock), those in which there are big multiple tracks, or patients suffering from severe shock or loss of blood who cannot bear a proper excision.

It does not appear that the resulting deep scars in muscles give much functional trouble afterwards; but if the favourable period for suture is missed by reason of suppuration, considerable crippling of the divided muscles may result.

Bayonet wounds are very seldom seen. Probably nearly all are fatal.

Wounds of Arteries.—Division of a main vessel in the leg (common femoral, popliteal, both tibials) nearly always leads to amputation. High wounds of the superficial femoral are not so disastrous. In a few cases suture or intubation (Tuffier's tubes) has been successful, even in popliteal cases.

For ANEURYSM and ARTERIAL HÆMATOMA, see pp. 50, 248.

Nerve Injuries.—(See article on NERVE INJURIES.)

Injuries of the Spinal Cord.—The great majority of these injuries are quite hopeless from the first, and nothing can be done. There is a large early mortality, within a few days; the survivors may linger for months or even years, dying at last, usually of septic infection of the kidneys. There is often a little transient and delusive improvement in the paralysis or anæsthesia of the legs, one or two muscle-groups showing some recovery, but not enough to be useful.

Fortunately there are a few cases that are capable of better things. When a missile is lying in the spinal canal, it is worth while to cut down upon and remove it. Very great relief of pain may be obtained, and occasionally the paralysis may clear up. This is especially likely to occur if there is evidence that the spinal cord is not completely divided, as shown by presence of reflexes, or an incomplete paralysis or anæsthesia. Cauda-equina cases also give some room for hope.

It occasionally happens that all the symptoms of a complete lesion may be present from the first, when the missile never touched the cord. The paralysis is due either to concussion, or to small hæmorrhages. These cases do not always clear up, unfortunately. If they are going to do so, the recovery will take place usually within a few days, or within a month at the most. Marked wasting of the legs is a sign that no further improvement can be expected.

PENETRATING WOUNDS OF THE ABDOMEN.

The immediate dangers of wounds of the abdominal viscera are very great ; the late dangers are less—much less, for instance, than in the case of the chest or knee-joint. The principal risks are death from hæmorrhage or shock during the first two days, and from the toxæmia of intestinal paralysis or of gas gangrene during the two days following. These constitute what is sometimes called late or secondary shock. General peritonitis seems to play a relatively small part ; one does not often see the clinical picture so characteristic of perforated gastric ulcer, with a distended abdomen containing red sticky gut covered by lymph clot, with a copious exudate. Apart from operation, the great majority die, but a fair number, mostly shot through the solid viscera, recover. It is quite certain, however, that men may live whose intestines have been perforated. Col. Wallace quotes some instances. During the South African War it was the rule not to operate, and Sir G. Makins reported 143 recoveries out of 207 patients. But there is no doubt that, owing to transport difficulties, a large proportion of the cases never reached the surgeon, and, if they did, it was too late for operation to do any good. In the Russo-Japanese and Balkan Wars, also, expectant treatment gave the better results.

During the first year of the recent Great War, both the British and the French military surgeons adopted the same line of treatment ; but when it became realized that the majority of the patients died from hæmorrhage, and that lives could be saved by early intervention, operation became the rule. According to Wallace, the death-rate was about 80 per cent in the pre-operation period (30 per cent out of 1098 died in field ambulances, 56 per cent out of 131 in six casualty clearing stations, and a certain number also at the base).

The general mortality amongst cases operated upon is about 50 per cent. Of 959 cases, some operated on and some not, treated at a group of casualty clearing stations during a battle in 1917, 67 per cent died ; of 500 operated on, 45 per cent died.

RESULTS OF OPERATION FOR PENETRATING WOUNDS OF THE ABDOMEN.

AUTHOR	Operations	Recovered	Recoveries per cent
Lockwood, etc., an advanced casualty clearing station, 1915-16 - - -	356	171	48
Walters, etc., an advanced abdominal hospital, 1916 - - - - -	500	245	49
Wallace, group of casualty clearing stations 1915-17 - - - - -	965	444	46
Group of casualty clearing stations, 1917 (during the progress of a battle) - - -	500	227	45

The main factor influencing the result is the time of operation. Under twelve hours, 105 lived and 107 died ; over twelve hours, 39 lived and 70 died (Wallace). After 36 hours it is probably better for the patient not to be operated on, unless for localized conditions.

A certain number of cases still recover without laparotomy, with a wound which is supposed to have traversed the viscera. These are mostly wounds of the upper abdomen involving solid organs. In a group of casualty clearing stations during 1917, of 452 patients not operated on, 71 got well enough to go down to the base.

We turn now from the general to the particular.

Bullet wounds appear to be just as serious as those due to shell or shrapnel. Wallace gives the following table :—

RELATIVE MORTALITY OF DIFFERENT PROJECTILES.

BULLET		SHELL FRAGMENT		SHRAPNEL		BOMB	
To Base	Died	To Base	Died	To Base	Died	To Base	Died
50	63	46	68	10	21	30	31

Wounds of the upper abdomen are less dangerous than those of the lower, unless the chest and diaphragm are also injured. This is a very fatal combination. Long in-and-out transverse wounds of the middle abdomen are also very serious. If the bowel is herniated through a gap, recovery is very improbable.

The pulse-condition and pulse-rate are very important guides to prognosis. If the pulse-rate is under 85, three-quarters of the cases do well; above 110, the mortality mounts rapidly, and over 120 the death-rate is 80 per cent (Walters).

A flaccid abdomen in a man who is obviously shot through the intestine is said to be a certain sign of death.

The patient often arrives exhausted with his rough journey, and it is important to wait two hours to see what degree of recovery is obtained in response to remedies (warmth, salines, hot coffee, omnopon, etc. These last may not always be suitable). If there is no marked improvement in two hours, the patient will probably take a day or two to revive, or more probably he will die.

The nature of the operation influences the prognosis. Speed, a warm table, and a suitable anæsthetic, such as warm open ether, all help. Resections of gut are relatively unfavourable. Lavage is not advisable.

After operation, vomiting persisting after the first day or two is ominous. The patient seldom dies if the bowels can be got to open. If he lives three days, has ceased vomiting, the bowels are open, and there is no evidence of gas gangrene, he has at least a 90 per cent chance of complete recovery.

Prognosis in Relation to Different Viscera Injured.—In practice it is common for several viscera to be injured in the same patient; this of course reduces his chances, but we shall here consider only uncomplicated cases.

RESULTS OF OPERATION FOR UNCOMPLICATED PERFORATION OF BOWEL.

AUTHOR	STOMACH			SMALL INTESTINE			LARGE INTESTINE		
	Cases	Recovered	Recoveries per cent	Cases	Recovered	Recoveries per cent	Cases	Recovered	Recoveries per cent
Walters, etc. -	9	6	66	122	58	47	58	23	39
Lockwood, etc. -	4	3	75	57	33	53	38	20	53
Wallace -	55	26	47	245	85	34	151	63	41
Fraser, etc. -	23	10	43	96	37	38	85	37	43
Total -	91	45	49	520	213	40	332	143	43

Stomach.—As will be seen from the tables, wounds of the stomach are slightly the most favourable, owing to the thickness of the wall and less tendency for a small hole to leak. About half the patients are saved. As Elliott and Henry have shown, there is some danger of late ulceration, hæmorrhage, and perforation in the second and third weeks. They suggest that extractives (beef tea, oxo, bovril, soups, etc.), which excite a flow of gastric juice, should be avoided in feeding.

Small Intestine.—Forty per cent of the patients with one or more holes in the intestine, but no other visceral injury, have been saved. At special centres (Walters, Lockwood, and collaborators) half have recovered.

The outlook is grave if the abdomen is full of infected blood, and the results after resection are much less favourable than after suture, in all statistics. Thus:—

Walters, etc.	-	64 cases sutured, 40 lived = 62·5 per cent
"		58 " resected, 18 " = 31·0 "
Wallace	-	130 " sutured, 59 " = 45·0 "
"		115 " resected, 26 " = 22·0 "

In each case resection, as compared with suture, halved the chances of recovery. No doubt the resected patients were more severely injured, on the whole.

There seems to be no difference in the figures for lateral and for end-to-end anastomosis. Wounds of the duodenum are very fatal; wounds of the jejunum and ileum much about the same.

Large Intestine.—Approximately the same results are found here as in the small intestine. Missed or inadequately closed retroperitoneal wounds are responsible for most of the mortality, the patient dying of sepsis, whereas small-gut cases die of shock, hæmorrhage, or toxæmia from intestinal palsy. The patient is often carried off suddenly by an acute septicæmia, with a pulse rapidly rising to 150, and respirations to 40. The *B. perfringens* is responsible for some of these deaths.

Tying in a Paul's tube, or proximal colostomy, is to be avoided if possible, as the following figures show :—

Walters, etc.	45 cases	sutured	-	-	21 lived	= 46·6 per cent
"	13	colostomy	-	-	2	" = 15·0 "
Wallace	102	sutured	-	-	50	" = 49·0 "
"	49	artificial anus	-	-	13	" = 26·0 "
"	14	proximal colostomy	4	"		= 28·0 "

Once again this must be qualified by allowing that the colostomy patients may have been more gravely injured to necessitate it.

Rectum.—These are not very favourable. Suture, with a proximal colostomy, probably gives the best results in intraperitoneal cases. For extraperitoneal wounds it is usual to provide free local drainage, with a transverse or inguinal colostomy. About one-third recover.

Bladder.—About 40 per cent recover. The majority die early of shock or hæmorrhage; a few succumb later, from sepsis.

RESULTS OF OPERATION FOR UNCOMPLICATED WOUNDS OF PELVIC ORGANS.

AUTHOR	RECTUM			BLADDER		
	Cases	Recovered	Recoveries per cent	Cases	Recovered	Recoveries per cent
Walters, etc. -	3	2	66·6	9	5	55·5
Lockwood, etc. -	—	—	—	13	5	38·5
Wallace -	8	3	37·5	25	11	44·0
Fraser, etc. -	10	3	30·0	14	4	28·0
Total -	21	8	38·0	61	25	41·0

The best results in intraperitoneal wounds are obtained by suture, with drainage of the peritoneal pouch between the bladder and rectum, with a catheter tied in the bladder. In extraperitoneal cases it is usually impossible to suture, and free drainage must be provided through the wound track. Opinion differs as to whether it is necessary to perform suprapubic cystotomy also.

Liver.—Wounds of the solid viscera are much less dangerous than perforations of the bowel, the principal source of danger being hæmorrhage, with a smaller and later risk from sepsis. It will be seen that about two-thirds got well with operation, although some of these were complicated cases, and many recovered without a laparotomy. The liver resists infection badly, and large jagged bits of shell, with clothing, are likely to cause serious trouble if left inside.

In a certain proportion of the cases—the exact frequency being in doubt, but certainly less than 20 per cent—further grave risks await the patient after surviving the immediate dangers and reaching a base hospital. These risks are abscess of the liver, subphrenic abscess, septic biliary peritonitis, and severe secondary hæmorrhage into the peritoneal cavity, usually about the tenth day. These accidents are all most likely to occur if a large fragment of shell is retained in the liver. Another less serious trouble is a long-lasting biliary fistula.

RESULTS OF OPERATIONS FOR WOUNDS OF THE SOLID VISCERA.

AUTHOR	LIVER			SPLEEN			KIDNEY		
	Cases	Recovered	Recoveries per cent	Cases	Recovered	Recoveries per cent	Cases	Recovered	Recoveries per cent
Walters, etc.*	27	13	48	11	6	54.5	10	6	60
Lockwood, etc.	29	20	69	4	3	75.0	13	9	69
Wallace	114	76	66	32	16	50.0	45	31	68
Fraser, etc.	33	19	57	14	9	64.0	29	17	58
Total	203	128	63	61	34	55.0	97	63	65

*Uncomplicated.

Spleen.—Wounds of the spleen are somewhat more dangerous, but more than half recover after operation, and probably many more have got well without laparotomy. It is safer to stop the bleeding by suture and packing; splenectomy is much more serious, and should be reserved for big lacerations or wounds of the hilum.

In Colonel Wallace's 16 cases of suture, etc., 12 recovered; of 16 cases of splenectomy, 4 recovered. The eventual prognosis after loss of the spleen is quite good.

Kidney.—Two-thirds recover after operation, and others get well without. In ordinary, all that is necessary is to plug or suture the bleeding laceration. Nephrectomy at the front has a mortality of 50 per cent (Wallace); it should be reserved for urgent cases of uncontrollable hæmorrhage with a pulped kidney or lacerated ureter.

Secondary hæmorrhage is apt to occur on or after the tenth day, due to infection, the urine containing much blood and many streptococci. The clot may block the bladder, as in a case of my own. The treatment is nephrectomy. Sir G. Makins reports 8 cases with 6 recoveries, at various base hospitals.

REFERENCES.—Walters, etc., *Lancet*, 1917, i, 207; Lockwood, etc., *Brit. Med. Jour.* 1917, i, 317; Wallace, *Lancet*, 1917, i, 561, 597, 637; Fraser, etc., *Brit. Med. Jour.* 1917, i, 321; Makins, *Brit. Jour. Surg.* 1916, April, 645.

WOUNDS OF THE SKULL AND BRAIN.

The experience of recent wars has brought rather a surprise in that so many men shot through the brain have recovered. No doubt the great majority are instantaneously killed, but quite a large number come under medical care. The introduction of the 'tin hat' certainly saved many lives.

On arrival at the casualty clearing station or base hospital, the practice was to operate on all cases unless the patient seemed to be moribund either on account of considerable loss of brain substance, enormous area of depression, or multiple injuries. Exact statistics are not available, but if no operation was performed, many patients died of meningitis, cerebral abscess, or compression, and there were some with a permanent paralysis that might have been avoided.

Experience shows that the best results are obtained by early operation, usually at the casualty clearing station, with excision of wound, nibbling away of the bone edges injured, trimming of the dura, removal of the foreign body if within reach of the finger, and also of depressed bony fragments, pasting of the wound, and closure, with glove-finger drainage. Leaving the wound open leads to infection and hernia. Scalp wounds excised, pasted, and sutured almost invariably heal by first intention. The patient's chances are seriously jeopardized if he is allowed to travel to the base in less than seven to ten days after operation.

With regard to the actual number saved, published figures are difficult to read and render comparable, on account of differences of date, place, and type of operation.

At the casualty clearing station in France with which the writer was connected, there were a total of 91 operations on the lines above described, with 21 deaths, between July, 1916, and September, 1917. The Somme battle period is included, and at this time many slighter cases were sent down without operation. In the quieter period following, almost

all patients with gunshot wounds of the skull or brain, if they were not moribund, were operated on. The death-rate is therefore higher than it would be at a base hospital. Very few patients evacuated would be in danger of dying later.

MORTALITY AFTER OPERATION FOR WOUNDS OF THE SKULL AND BRAIN.

Author	Cases	Deaths	Mortality per cent
A casualty clearing station July, 1916-Sept. 1917 - - -	91	21	23.0
A base hospital, France, Sept. 1915	392	58	14.8
A base hospital, Egypt, 1915 -	104	19	18.2

At a base hospital group in France, reported on by Sir H. M. W. Gray, during September, 1915, there were 392 operations on the lines described above, with a death-rate of 14.8 per cent. At that time most of the operations were done at the base, not at the casualty clearing station. If 12 hopeless cases are excluded, the death-rate was 9 per cent.

At a hospital in Egypt during the Dardanelles campaign, Captain Whitaker gave figures of 104 patients operated on, with a mortality of 18.2 per cent. Of these, 88 had an intradural injury, whereof 19 died. Of the 64 with intradural injury who had not previously been operated on, only 9.3 per cent died. At this hospital, flaps were turned down and the wound was left open. Amongst the recoveries, there was incontinence of urine in one case, some hemiplegia or monoplegia in five cases, and lesions of the cranial nerves in two. The rest were completely restored.

Some information is also available with regard to the eventual prospects of these patients. Of course, if a considerable part of the motor cortex, visual area, or speech centre is destroyed, there will be a permanent impairment, and to some extent the nervous troubles discussed under HEAD INJURIES are also met with. In regard to 610 patients examined in England more than three months after being wounded, it is surprising how well they had got on. The late death-rate is small (46 in 1239 cases at eight London hospitals, i.e., 3.7 per cent). Many of these were hopeless from the first, and only 5 died after three months. Many cases evacuated to England with hemiplegia or diplegia improved up to complete recovery, especially when the injury was to the superior longitudinal sinus. Mental symptoms also usually improved. Six per cent suffered from fits, but in many of these they did not recur. Headache and emotional changes were common. In 69 patients a missile was still in the brain; of these, 4 died, one from an unconnected cause. There were fits in 4 cases. Thirty per cent were completely well in all respects; the rest showed various symptoms or were not yet healed. In only 10 per cent were serious disabilities, such as hemiplegia, present. Not many patients, however, were followed for more than a year, and some of those returned to duty have become unfit subsequently.

With reference to the prognosis in individual cases, large skull defects, loss of much brain substance, through-and-through brain wounds, and lodgement of large pieces of shell are all of very bad omen. Symptoms of meningitis (irregular fever, delirium, head-retraction, optic neuritis, late paralyses, turbid cerebrospinal fluid) are almost a death warrant. Cheyne-Stokes breathing, or a very high temperature, usually points to imminent death. Prolonged coma, restlessness, and convulsions are not necessarily grave signs, but such patients will probably have marked nervous symptoms for months or years if they recover. On the other hand, patients who are conscious before operation nearly all do well.

Extradural injuries are much less serious than intradural, but in a certain number of cases the underlying brain is pulped and may suppurate. Sir H. M. W. Gray therefore advised that the dura should be opened even if unwounded, when it is seen not to pulsate, provided a clean operative field has been obtained, and especially if paralysis is present. The purpose is to hasten and perfect the cure by removing pulped brain tissue, which may act as a focus of irritation and form a big scar.

We may summarize as follows:—

1. The majority of cases of gunshot injuries of the skull and brain die on the field, especially the through-and-through wounds of the brain.

2. Of those patients reaching the base hospitals not moribund, 85 to 90 per cent may be saved by operation.

3. The more severe type of injury met with at a casualty clearing station can be dealt with successfully in three-quarters of the cases, and the earlier operation saves more lives, if the patient can be kept a week or two afterwards.

4. Only about 10 per cent of the patients who recover suffer from permanent paralysis or insanity, and 6 per cent have fits, often only one or two seizures. A good many show various neuroses such as headache and emotional changes.

5. A small retained missile does not appear to be very serious if the patient survives the first week. The late death-rate is very small, and very few suffer from fits. The majority recover well; a third were completely cured in three to twelve months.

6. Paralyses present just after the injury often clear up either early or late after operation, especially when due to injury of the superior longitudinal sinus.

REFERENCES.—Gray, *Brit. Med. Jour.* 1916, i, 261; Whitaker, *Brit. Jour. Surg.* 1916, April, 708; Sargent and Holmes, *Jour. R.A.M.C.* 1916, Sept.

PENETRATING WOUNDS OF THE CHEST.

As usual, a sharp distinction must be made between rifle or machine-gun bullet injuries, which are usually small and sterile, and those inflicted by shrapnel, fragments of high-explosive shells, or bombs, which are nearly always infected. Examination of the chest fluids within the first few days shows that approximately three-quarters of the infected cases are contaminated by streptococci, and half by anaerobic bacilli.

The total mortality of all chest wounds in France, up to the middle of 1917, was about 25 per cent, whereof 20 per cent died at the casualty clearing station, field ambulance, or regimental aid post, and 5 per cent at the base. At one very forward casualty clearing station in 1917, however, the mortality was 30 per cent. Depage's figures for the French army (1916) were about the same. He found that bullets gave a death-rate of 11 per cent, and shell fragments 29 per cent.

Of 676 cases of pure chest wounds seen at base hospitals in France, Elliott found the following figures :—

General mortality on lines of communication	-	5.8 per cent
Deaths in septic cases	- - - - -	40.0 "
Proportion of septic cases to all	- - - - -	14.0 "
Incidence of sepsis in cases with effusion	- - - - -	20.0 "

Small In-and-out Wounds.—These almost always do well if the heart (*see* p. 267), great vessels, and diaphragm are uninjured, and unless sepsis occurs. The great majority develop a hæmothorax, large or small; a smaller number present either a pneumothorax, or no physical signs in the chest. Both these latter classes soon recover.

Of cases of hæmothorax, as the above statistics show, the larger number fortunately remain sterile, and it may or may not be necessary to aspirate. Of 49 such cases followed up at least three months, about half (24) were fit for duty in three months, and nearly all the rest were fit in six months. One was not fit after three months; four were incapacitated by other lesions, and one died after an operation to remove a foreign body. These figures include a certain number of cases with retention of an aseptic foreign body. Apparently the recovery is nearly as perfect when the hæmothorax is large as when it is small, but it takes longer; less than half (9 out of 22) were fit in three months, whereas with a medium or small effusion 15 out of 27 were fit in that time.

According to Elliott's figures in 20 cases, a small sterile hæmothorax does just as well if it is not aspirated; 14 were fit in three months, and 6 in six to eight months; 11 of these had an effusion estimated at twenty to forty ounces, well up into the axilla.

Retained Foreign Bodies in the Lungs or Pleura.—Such missiles are likely to carry in septic infection, especially in the case of fragments of shrapnel or high-explosive shell. Bullets or small fragments may, however, remain sterile, and in that case the prognosis does not appear to be much worse than with in-and-out wounds. Of 14 such cases followed up, 4 were fit for duty in three months, 7 in four to fifteen months, 2 were unfit in consequence of nerve lesions, and 1 was dead after an operation to remove the bullet.

In many cases retention of a foreign body is followed by infection, and a septic hæmothorax or abscess of the lung develops. When the retained fragment is larger than a small hazel-nut the danger becomes very great, especially if the wound in the chest wall is open for the pleural cavity to communicate with the outside air. The ideal treatment is early operation under a local anæsthetic, excision of the track, removal of the foreign body, cleansing of the pleural cavity, and closure without drainage. Apart from successful removal by operation, very few patients with a large piece of shell retained in the lung ever got down to the base alive. When the fragment was small enough for the patient to reach the base in safety, only 21 per cent (out of 83 patients) developed a septic hæmothorax or empyema.

Open Wounds.—These wounds are very dangerous. Apart from operation the great majority died at or before they reached the casualty clearing station. When a large foreign body is retained the risks are greater still, death resulting within a few days from hæmorrhage, shock, mechanical displacement of the thoracic viscera, or virulent sepsis, anaerobic or streptococcal.

Greatly improved results were obtained later by early operation, best under a local anæsthetic, designed to cleanse the track by excision, remove the foreign body, and clear out and close the pleural cavity. Captain Anderson succeeded in saving 44 out of 58 such cases, most of the fatalities suffering from multiple wounds; twelve patients required a secondary operation for drainage. Captain Lockwood operated on 36; only 9 died, and none needed re-opening. To obtain access to the shell fragment it is usually necessary to resect a long piece of one or two ribs. I have used intratracheal anæsthesia in such cases with good success, but it is not necessary as a routine. There is some risk of pneumonia in the other lung. One of my patients died on the table from hæmorrhage, the huge shell fragment having been driven into a main branch of the pulmonary artery.

Captain Roberts and Craig saved 10 out of 29 'open' cases, and in several of the failures death was due to other injuries. During one of the later battles, 108 out of 255 chest cases operated on at casualty clearing stations died (42·3 per cent).

The subsequent history of patients operated on thus early appears to be satisfactory. I am privately informed that there were only 8 deaths at the base out of 183 chest cases operated on at a casualty clearing station. Secondary drainage was required in 32, of whom 4 died. Of 51 cases sent down with pleura closed, 2 died; of 35 sent down with pleura drained, 4 died.

Infected Cases.—About 14 per cent of the whole number of chest cases seen at base hospitals showed evidence of sepsis, or 20 per cent of those with effusion, and of these, 40 per cent died. Of the survivors, 64 were followed up, and it was found that the results were :—

Fit for duty in six months or less	-	18	cases
Fit for duty in over six months	-	11	„
Unfit	-	20	„
Unclassified	-	15	„

About 60 per cent of those who survive, therefore, make a perfect recovery. The outlook is by no means so good if a foreign body is retained. Only 30 per cent of these became fit for duty.

The unfit suffer from a persistent sinus or from chronic cough and expectoration.

We may briefly summarize as follows :—

1. Of all chest wounds, at least one-quarter die.
2. Small in-and-out wounds without effusion almost all recover.
3. The majority develop hæmothorax. Four-fifths of these remain sterile; half are well in three months, and nearly all the rest in six months. Except in large effusions, aspiration does not hasten matters.
4. A small non-infected foreign body, with hæmothorax, is not dangerous, and the patient recovers fitness, but not so quickly.
5. Cases of open chest wounds, and those with retained shell or shrapnel larger than a hazel-nut, nearly all die unless there be early operation, which saves about half of them.
6. Of infected cases treated by rib resection and drainage, nearly half die. Of the survivors, two-thirds recover in about six months; or only one-third if a foreign body is retained.

WOUNDS OF JOINTS.

It is very especially true in the case of the joints, that the prognosis depends on whether infection does or does not develop. If the wound maintains an aseptic course, recovery will take place usually with a fair degree of mobility of the joint ; often complete mobility if the joint surfaces are approximately intact. If there is infection, a mobile joint is unlikely, and there is grave fear of prolonged suppuration, amputation, or even death.

Knee-joint.—We shall consider the case of the knee-joint first, as the information here is much the most abundant.

In-and-out rifle or machine-gun bullet wounds, with a small exit and entry, nearly always do well, and give a perfect or nearly perfect result, without any operation being necessary. Shell wounds, or rifle-bullet wounds with a large exit, almost all require early operation, or sepsis is fairly certain to supervene. Even if the case does well for some days or weeks, it is very disappointing to find that late suppuration ensues, as I have seen on several occasions at an English hospital.

The general prognosis during the period of the battle of the Somme, June to December, 1916, in cases of knee-joint injury requiring operation, was shown by the Rouen figures :—

Lesions with bone injury	-	438
„ without „	-	407
Total	-	845
Total amputations	-	164 = 19·4 per cent
Total deaths	-	72 = 8·5 „

There is no doubt that much better results can be obtained by the widespread application of a satisfactory technique, including excision of the wound, cleansing of the joint (the writer uses 1–1000 brilliant-green, and finds it very reliable), removal of foreign bodies, closure of the joint-cavity by suture, and the use of a reliable antiseptic such as that used in the Carrel-Dakin treatment, B.I.P.P., or, best of all, a flavine or brilliant-green boric paste, followed by efficient fixation of the knee. If the joint-cavity can be closed, the great majority of the cases heal by first intention, even if the patella is split or there is some not extensive damage to the femur or tibia.

Of 322 such cases in the Rouen figures, only 82 required further operation ; that is to say, three-quarters did well. To-day, the proportion in properly treated cases is undoubtedly still higher. Ogilvie, working in a French base hospital, obtained by this technique the following results :—

Cases operated on (his classes B, C, D)	-	47
Clean movable joints	-	27
Limited mobility	-	4
Stiff joints	-	14
Amputated	-	1
Died	-	1

The results are in reality better, because in some of these it was not possible to close the capsule. This particularly applies to the unsatisfactory cases.

When the bones entering into the joint are extensively smashed, a primary excision may avert the necessity for amputation. In this case, of course, a stiff joint results.

When the joint cavity cannot be closed, the prospect of sepsis is greater. In the Rouen figures, 38·4 per cent of the 336 cases in this group required a further operation. The others presumably did well, but would not be likely to get a perfectly movable joint.

When infection occurs, the outlook becomes much graver. The type of wound that is likely to lead to infection can often be recognized beforehand. If the patient comes under treatment more than forty-eight hours after injury with an open leak of the joint ; if the capsule cannot be closed ; if there is much bony comminution ; if a piece of shrapnel or cloth is retained ; or if the vitality is reduced by grave hæmorrhage or multiple wounds, the risk is much increased.

In the Rouen figures, when the cases that required no further interference after a conservative operation on the joint, and therefore presumably remained aseptic, are

deducted from the total number, there is a residue of 397, and there were in the whole series 72 deaths and 164 amputations. Excepting a few multiple injuries, all the deaths probably came into this group, so it is clear that not more than half the infected knees preserved life and limb, and perhaps not more than one-third when we take into account the fact that during the Somme battle a large number of legs were amputated in hospitals in England for suppurative arthritis of the knee.

END-RESULTS OF SEPTIC ARTHRITIS OF KNEE.

Author	Cases	Recovered		Amputated	Died
		Bony union	Mobile		
Rankin (excision)	29	18	—	3	8
Campbell and Wolfenden (arthrotomy)	20	7	10	1	2
Page (arthrotomy)	21	12		4	5
Total	70	47		8	15

Individual surgeons have obtained much better results than these by the use of a special technique. Fullerton and Rankin excise the joint. Rankin obtained 18 recoveries with bony union out of 29 operations, with 3 amputations and 8 deaths. Campbell and Wolfenden used lateral and posterior incisions for drainage, followed by Carrel's treatment, and saved 17 out of 20. This is the method I use, and I find it very satisfactory ; it is important, in my opinion, to remove the posterior ends of both semilunar cartilages. Page, by other methods of drainage, saved 12 limbs out of 21. It will be seen that the lateral and posterior drainage method gives the best results. Of 17 cases, 7 obtained firm bony ankylosis, and in 10 the joint preserved some mobility.

Willems recommends early active movements in a suppurating joint, to press the pus out, and if the patient can be persuaded to carry it out the results are often very gratifying.

We may come, therefore, to the following conclusions :—

- 1. Small in-and-out bullet wounds without much bone injury nearly all give a good result.
- 2. Shell wounds in which early cleansing and closure of the joint-cavity is possible do well in at least 75 per cent of the cases. The joint usually recovers good movement, but may be more or less stiff.
- 3. When the joint cannot be closed, or in the presence of an extensive smash of the bones, retained foreign body, etc., the risk of sepsis is great.
- 4. If suppurative arthritis occurs, in practice the majority of the patients may lose limb or life ; but with a proper technique of drainage, 75 per cent can be saved, with either bony ankylosis or a more or less movable joint in about equal proportions.

The other joints may be briefly dismissed, as published statistics do not appear to be available.

Hip-joint.—Wounds of the hip-joint are not common. If the patient survives the immediate risk of what is likely to be a severe injury, it is rather surprising how well the arthritis of an infected hip-joint responds to anterior and posterior drainage and Carrel's treatment. During the Somme battle period the writer had six such cases under his care in England, and all recovered. The hip was stiff, and in several there was considerable shortening due to dislocation upwards.

Ankle-joint.—Wounds of the ankle-joint are difficult to preserve from sepsis. I have had a good result, with primary healing, from astragalectomy within a few hours of the injury in one case in which the bone was shattered. If suppuration occurs, the foot may be saved, but, according to my experience at an English base hospital, it is too painful for walking on ; and I believe it is better to perform Syme's amputation.

Shoulder-joint.—Here the conditions and prognosis much resemble those in the knee.

Elbow-joint.—The elbow-joint is difficult to close satisfactorily, and in consequence

many of the wounds suppurate. Early excision has not been very successful; many of the joints left after this procedure are either flail or ankylosed, especially if the olecranon is sacrificed. Perhaps now that better means are available of preventing sepsis (pastes, etc.), better results may be obtained. If infection occurs, the most efficient way to drain the joint is to saw through the olecranon, and restore it when all is quiet.

Wrist-joint.—This joint is also difficult to close, and infection is therefore common, but it can usually be controlled by Carrel's treatment or the antiseptic pastes. A stiff wrist is likely to result.

REFERENCES.—Gray, *Brit. Med. Jour.* 1915, ii, 41; Barling, *Ibid.* 1917, ii, 277; Ogilvie, *Ibid.* 280; Page, *Ibid.* 282; Rankin, *Ibid.* 287; Fullerton, *Ibid.* 1916, ii, Nov. 25; Campbell and Wolfenden, *Lancet*, 1917, ii, 185.

COMPOUND FRACTURE OF THE FEMUR.

This may be taken as a type of bone injury due to shell or gunshot wound, except that the prognosis, both immediate and remote, is much less favourable for the femur than for other bones. Information as to the end-results is not yet available, and we do not know what degree of functional recovery to expect.

The risks to life are early, and late. The early risk is death on the battlefield, at or on the way to the casualty clearing station, or even at the base, from hæmorrhage, shock, gas gangrene, or acute streptococcal septicæmia. The death-rate at the casualty clearing station is probably about 15 per cent; some of these cases present multiple injuries, those to the femur predominating. These figures agree with those given for 1000 cases by Sir Anthony Bowlby in April, 1916, and with the statistics for about the same number of cases after fighting in the early summer of 1917. Sir Anthony Bowlby estimates that another 2 per cent die before reaching the clearing station. Many more die on the battlefield.

Arrived at the base, the late risks have to be faced. Major Hey Groves, working in Egypt and receiving from the Dardanelles, had a mortality of 10 per cent; Major Martin, working at the base in France in 1915, reported the late mortality as 15 out of 52 (10 died in France, 5 in England), that is, nearly 30 per cent.

According to some surgeons who were working at the front in the earlier part of the war, the death-rate at and in front of casualty clearing stations was much higher than that quoted above. Sir H. M. W. Gray estimates that the total mortality, early and late, was as high as 70 to 80 per cent. Later in the war it was probably under 30 per cent, because cases were kept longer at casualty clearing stations, and the number of deaths at the base and in England was greatly reduced. The improvement was due to better methods of fixation and of wound treatment (excision, Carrel's method, pastes).

Of a group treated at casualty clearing stations in 1917, 174 out of 1009 were amputated (=17.2 per cent). It is difficult to say how many more were amputated at the base or in England; during the Battle of the Somme the proportion amputated at the English base was by no means inconsiderable.

Information is also lacking as to the end-results. Hey Groves reported of the Dardanelles cases that 75 per cent of the legs saved showed good form and function. They were treated by transfixion and extenson. This figure is certainly higher than the general average. Clean breaks due to gunshot injury may do very well; comminutions at the bottom of a big wound, even if life and limb are saved, are apt to show a persistent sinus, or great shortening.

One may estimate—but it is little better than a guess—that at the present time 20 to 25 per cent die, another 20 to 25 per cent need amputation, and of the rest, perhaps a third get a good functional limb without much shortening, or a sinus. The best results would be after a clean break due to a bullet. I have seen one such patient who lay seven weeks untended, except by a wounded comrade, behind the German lines after a raid, and crawled to his own trench when the leg was sufficiently united to enable him to do so. He had $1\frac{3}{4}$ in. shortening. (*See also FRACTURES.*)

I am much indebted to Sir H. M. W. Gray for help in writing this article.

REFERENCES.—Bowlby, *Brit. Jour. Surg.* 1916, April, 626; Hey Groves, *Ibid.* 592; Martin, *Ibid.* 632.
A. Rendle Short.

HÆMATOCELE, PELVIC.—(See ECTOPIC PREGNANCY.)

HÆMATOMA, ARTERIAL.—Recent rupture of an artery, subcutaneously or after a punctured wound, is a very serious injury which urgently demands surgical interference to prevent gangrene or fatal loss of blood. There has been some difference of opinion as to which operative procedure will lead to the best results. Thus Guibé has collected from the literature 78 cases of rupture of the axillary vessels in association with dislocation of the shoulder, 57 being due to efforts at reduction, especially by extension or the heel-in-axilla methods. One would have expected that incision and tying the vessel would have given better results than ligature of the subclavian, and it also allows of reduction of the dislocation; but in the records the incision method shows a mortality of 31 per cent and 44 gangrened, whilst ligature of the subclavian cured 80 per cent and only 20 per cent became gangrenous. The figures are, however, too few to prove the point, and go back into the pre-antiseptic era.

A larger and more reliable body of statistics, which we owe to the researches of Monod and Vanwerts, shows that the best results in every situation were obtained by restorative methods or by compression of the feeding artery, opening the hæmatoma, and ligature *in situ*. The results are shown in this table:—

Method	Cases	Cured	Died	Gangrene	Failed
		per cent	per cent	per cent	per cent
Proximal ligature - - -	41	60·5	14·6	7·5	12·0
Incision and ligature <i>in situ</i>	17	81·5	10·0	6·5	1·2
Obliterative aneurysmorrhaphy - - -	1	100·0	—	—	—
Reconstruction of artery -	39	87·0	5·0	5·0	5·0

With reference to the individual vessels, the same writers relate 17 cases of injury to the **Carotid**, of which 6 died and 4 developed cerebral troubles.

Four cases of wound of the **Brachial** artery and vein all did well. Although ligature of the **Femoral** artery has a bad reputation for causing gangrene, only 2 out of 56 showed this complication, and in one of these the vein was injured. In 9 cases the artery and vein were both tied without causing gangrene. Most of these, however, were superficial femoral cases.

The **Popliteal** was much more disastrous; 9 out of 14 were gangrenous before operation, and 4 more became so afterwards. In several of these the vein was also injured.

Gunshot injuries of large vessels are in a somewhat different category. The patient has frequently lost much blood, and there is considerable risk that ligature of the artery will precipitate gangrene. If there is no external hæmorrhage, the swelling is not increasing, and the nutrition of the foot or hand is good, there is considerable probability that the condition will settle down and either produce an aneurysm which will be more amenable to safe treatment at a later date, or even get quite well with a pervious artery. In a series of picked cases reported on by Sir George Makins from base hospitals in France, about a third of the cases of hæmatoma of large arteries were transferred to England without operation, the condition improving. Probably at least half the patients will settle down in this way. How many of them get quite well is uncertain. They need to be constantly watched for hæmorrhage, extension of the swelling, malnutrition of the extremity, and suppuration. These would necessitate ligature or excision. When the artery has to be tied for one of these reasons, the prognosis depends upon the vessel. No sufficiently full statistics are yet available. In Sir George Makins' series from base hospitals in France, of the carotid cases 1 did well and 1 became hemiplegic. Two subclavian cases both died. Of 3 axillary cases 1 did well, another was already gangrenous but lived, and the third died. The brachial artery was tied 10 times, all the patients doing well except 1 in whom gangrene was already present. Of 4 cases of ligature of the common femoral, 2 did well, 1 died, and 1, though already gangrenous, recovered. The superficial femoral and profunda showed 15 successes, 1 case gangrenous (before operation), and 4 deaths. Of 5 popliteal injuries, all got well; 1 was gangrenous,

but lived. In no case was gangrene induced by the ligature, though the common femoral vein and artery were tied once, and the popliteal vessels twice.

REFERENCES.—Guibé, *Rev. de Chir.* 1911, 580; Monod and Vanwerts, *Ibid.* 1911, 663; Makins, *Brit. Jour. Surg.* 1916, iii, 353.

A. Rendle Short.

HÆMOPHILIA.—It may be well to make it clear at the outset what we understand by this condition. It may be defined as a disease, usually congenital, characterized by a tendency to hæmorrhage, which may be spontaneous or in connection with wounds or injuries. The essential defect is diminished coagulability of the blood. The disease affects males in the great majority of instances, and the usual history is that the tendency is transmitted through the females, who are not themselves bleeders. Bullock and Fildes have gone so far as to deny the existence of *de novo* cases, or of definite symptoms appearing in the female. We are inclined to think they have arrived at this conclusion by the somewhat arbitrary course of disparaging, or disregarding, evidence to the contrary, and we may say at once that we have seen and treated patients whose history and symptoms have convinced us that cases without hæmophilic ancestry do occur, and that severe hæmophilia may affect females.

Prognosis may be considered: (1) From the point of view of the expectation of life or recovery of the patient; and (2) In view of the hereditary aspects of the disease, as regards the chances of a patient transmitting it to posterity.

1. Prognosis as regards Patient.—This is always grave, especially in young subjects. As a rule, the condition does not show itself within the first twelve months of life. Some cases, however, are fatal shortly after birth from bleeding of the umbilical cord; the bleeding may be immediate or may not begin till the third day or later; it may be arrested, but is sometimes fatal within twenty-four hours.

The risk to life diminishes after early childhood. The child and his attendants learn to appreciate the danger of even slight knocks or scratches; and the essential defect seems to lessen. The seriousness of the outlook is illustrated by Grandidier's statistics. Out of 152 boy hæmophilics, 81 died before the end of the seventh year.

The longer a patient lives the greater is his chance of outgrowing the tendency. In many of the surviving cases it has disappeared at the age of twenty or thirty; but other cases reach a ripe old age, and exhibit symptoms to the end.

Something can be done by treatment to diminish the tendency to bleeding. The administration of lime has been lauded, but Addis has thrown grave doubt on the scientific reasoning on which this treatment is based; he holds that enough ionizable calcium to affect clotting cannot be absorbed. In one case we treated a child with intramuscular injections of calcium chloride (1 gr. daily) for a month without success, and have tried the same method in several other cases less perseveringly without any apparent effect. We long ago ceased to expect any benefit from calcium chloride or lactate given by the mouth. Definite improvement has followed the administration of horse serum. The administration is best made intravenously, since the elastic recoil of the venous wall and skin form an efficient bar to local bleeding. If patients can be got to submit to it, there is no doubt that an injection once a fortnight or once a month, carried on for years, greatly diminishes the tendency to bleeding. None of our cases have suffered from anaphylaxis; but it is well to inject a very small dose, say 1 c.c., and note its effects before giving a larger dose for the first time; in cases which have already been treated by serum, for diphtheria for example, the first dose should not exceed 3 or 4 drops. The injection of Witte's peptone has not been tried often enough for conclusions regarding its efficacy to be stated. It is indeed a matter of great difficulty to form an opinion regarding the efficacy of any line of general treatment, since the tendency to bleeding shows such extraordinary variations in the same patient at different times. After a serious or even dangerous hæmorrhage, the coagulability of the blood may increase to a degree approaching or reaching that of health, and this result may be ascribed to the last line of treatment employed. Residence in a warm climate seems to diminish the hæmorrhagic tendency in some instances.

There is no doubt that prognosis in hæmophilia has improved, owing to recent discoveries in connection with the coagulation of the blood. These have resulted in the addition to our armamentarium of the means of dealing locally with accessible hæmorrhages, means which were not previously available. Addis has shown that the diminished

coagulability of the blood is due to a great delay in the interaction between prothrombin and lime, which forms thrombin. The thrombokinase which is supplied by the damaged tissues may be washed away in the blood, escaping from the wound before it has had time to cause the prothrombin and lime to unite to form the thrombin which determines the change from fibrinogen to fibrin. The existence of a layer of fibrin on the edges of a wound may indeed play an important part in preventing access of thrombokinase to a bleeding point in the centre of the wound. The indication in such a case, therefore, is to remove coagula from a wound which is still bleeding and apply to it an abundance of thrombokinase.

Thrombokinase can be obtained by making an extract of chopped thymus or testis with 0.9 per cent saline solution to which a trace of sodium carbonate has been added.

Buswell¹ has stated that a powerful extract of thrombokinase can be made by washing sheep's fibrin in tap-water till it is hæmoglobin-free, and then kneading about 20 grms. of the wet fibrin in 300 c.c. of distilled water. So far as we are aware, this extract has not been tried in practice. In case of emergency, blood freshly drawn from a healthy subject, and applied to the bleeding surface, will often arrest the hæmorrhage.

These physiological styptics are more efficacious than those which depend on astringent or escharotic action, and moreover their use is not followed by the danger of recurrence of the hæmorrhage which sometimes takes place when an eschar separates.

Hæmorrhages are not alone dangerous *qua* hæmorrhage. Adherent clots in the posterior nares and among the teeth, and the presence of decomposing blood in the stomach and bowel, may lead to great discomfort, and sometimes to marasmus and death. Gangrene of large areas of skin and masses of muscle has followed hæmorrhages large enough to exert pressure on arteries.

Hæmorrhages and hæmo-serous effusions into joints are not dangerous to life, but may lead to permanent incapacity. They are often imperfectly absorbed, and frequently recur, with the result that adhesions, erosions, and osteo-arthritis, with subsequent ankylosis of varying degree, may be occasioned. Cases of fracture in hæmophilia have been recorded. A large effusion takes place, but satisfactory union usually occurs.

Menstruation and parturition in non-hæmophilic females of bleeder stock are not associated with special danger. Even female bleeders seem frequently to escape serious consequences at these times, but in some cases menstruation is a recurring anxiety; in the case of one young lady under our observation, a fatal result from menorrhagia has been very narrowly escaped on three separate occasions. Between these serious episodes there have been intervals of months or years when menstruation has given comparatively little trouble, although the susceptibility to bruising and accidental bleedings has persisted.

The examination of the blood is of comparatively little service in estimating prognosis in hæmophilia. We have never found the great reduction of polymorphonuclear leucocytes which has been described by authors, and in particular by Wright; and if it be remembered that many persons in perfect health never have more than 6000 leucocytes per c.mm., even the majority of Wright's own figures are not particularly low. An estimation of the coagulability of the blood is sometimes of more service; but when bleeding is in evidence we may take it for granted that coagulation time is prolonged, and when bleeding is absent the coagulation time in a bleeder may be no longer than in a healthy person. An estimate of coagulation time might conceivably be usefully made before a hæmophilic entered upon some special undertaking, such as a journey; but data regarding the coagulation time before hæmorrhages are very scanty.

The onset of spontaneous hæmorrhage, or of increased liability to traumatic hæmorrhage, is sometimes preceded by prodromal symptoms. Headache, nervous irritability and lassitude, and sometimes even convulsions, may occur; but whether these are associated with an actual diminution of coagulability is a matter of inference rather than of observation. In other cases, a special feeling of well-being may precede a spontaneous hæmorrhage.

To sum up: The expectation of life in the case of a young bleeder is poor; it is probably diminished by 50 per cent. This state of affairs lessens with advancing age. The necessity for constant care, the occurrence of joint-effusions and their results, and the incidence of spontaneous hæmorrhages, reduce all but the slightest cases of hæmophilia

to a condition of at least semi-invalidism. The danger of bleeding from accessible sites may be greatly diminished by the use of physiological styptics.

2. Transmission of the Disease.—The females of hæmophilic stock are fertile beyond the ordinary, and a study of the genealogy of hæmophilic families shows clearly that the great majority of the male offspring of the women, whether the latter are themselves bleeders or not, are likely to be hæmophilics. Women of hæmophilic stock should therefore be advised not to reproduce their species.

A male bleeder is obviously not a fit and proper person to assume the responsibilities of parentage; and apart from his personal disability, there is a definite, though comparatively slight, probability that he may propagate bleeders.

The question of marriage in non-hæmophilic males of a bleeder stock is more difficult. The man is under no personal disability, but there is rather more than a moderate risk that he may transmit the disease. We have published a genealogy in which a non-bleeder male of hæmophilic stock had two sons who died of hæmophilia. His non-hæmophilic daughter was twice married, and had hæmophilic offspring by both husbands. One of her sons, a non-bleeder, married a healthy woman, and had two sons who died of the disease.

REFERENCE.—¹*Jour. of Physiol.* 1913.

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A. Goodall.

HÆMORRHOIDS.—A patient suffering from ‘an attack of piles’ frequently asks whether he is likely to get better without operation. The answer depends on the condition found.

Thrombosis of an external pile, which is painful for a few days, usually gets quite well, and there may never be any further trouble.

Bleeding piles can fairly often be relieved, rather than cured, by dieting, purgatives, and local applications.

Strangulated prolapsed piles, in rare cases, cure themselves, after a painful illness, by gangrene.

A patient’s life is very seldom in danger from hæmorrhoids, but fatal embolism from a thrombosed pile has been recorded, and the bleeding, if unchecked, might even threaten life.

The injection into the pile of carbolic acid, repeated once a week on two or three occasions, will give considerable relief in a majority of the cases, but I have seen it fail, and there may be painful swelling afterwards. It is far less reliable than operation, but worth a trial if the patient refuses an anæsthetic. According to Sir C. Gordon-Watson, of 49 cases, 33 were cured and 7 finally came to operation. It is better for a single pile than for multiple piles. Ernest Miles says that he saw in France 139 unsatisfactory results from the attempted injection of piles at thirty-seven different hospitals. The prospect of cure by ionization is also very uncertain.

Results of Operation.—There are three operations in common use—namely, the ligature, the clamp and cautery, and the Whitehead operations.

Mortality.—This is as low as that of any operation can be. Swinford Edwards and other surgeons have treated thousands of cases without a death. At St. Mark’s Hospital, in forty years up to 1896, the mortality was 1 in 670; afterwards there were no deaths in many years.

After-discomfort varies with the method of operating. Pain is least with the clamp and cautery method, most after ligature. Stay in hospital was, on an average, ten days after the clamp and cautery, twenty-one after ligature, and twenty-six after Whitehead’s operation.

The two principal after-troubles are stenosis and recurrence.

Stenosis is unknown after the cautery operation; it occurs in slight degree, which is of no importance, after about a third of the ligature cases and half of the Whitehead cases. Stricture requiring treatment was met with in 8 out of 100 patients on whom Whitehead’s operation had been performed.

Recurrence is extremely rare if an efficient operation is performed in the first place; the writer has never met with a case. The end-results of piles operations are almost invariably extremely satisfactory. In eighteen months, at St. Mark’s Hospital for diseases of the rectum, only 2 recurrences were seen, one after two years and the other after

eighteen. The follow-up system recently instituted at the New York Hospital shows that between 1913 and 1918 there were 184 cases of piles operated on, with no deaths, and of 73 seen at various intervals afterwards only 3 were not satisfactory. It is maintained that all or nearly all of the 111 patients who could not be persuaded to attend for re-examination were cured.

The three operations ought not to be regarded as mutually antagonistic. The clamp and cautery is best for cases where there are only a few piles not involving the skin, because burns of the skin are painful. Whitehead's method is to be reserved for uncommon cases where the whole anal canal is a mass of piles.

REFERENCES.—Anderson, *Brit. Med. Jour.* 1913, ii, 1478 ; Swinford Edwards, *Burghard's System of Operative Surgery* ; Cripps, *Diseases of the Rectum and Anus* ; Gibson, *Trans. Amer. Surg. Assoc.* 1919, 429.

A. Rendle Short.

HEAD INJURIES.—The prognosis of a number of conditions will here be considered under one heading, because it is so difficult to distinguish between them in practice. The aphorism of Hippocrates still holds good : “ There is no head injury so trivial that it should be despised, or so serious that it should be despaired of.”

That the prognosis after a severe head injury is very uncertain is evidenced by the excellent hospital rule always to admit such cases if possible, as a precautionary measure ; it is quite impossible to tell what the outcome may be at the first examination. Every surgeon knows of patients lying deeply comatose, who appeared to be marked for death, who have recovered ; and, on the other hand, how often has a resident imperilled his reputation by sending away a patient with apparently nothing the matter, who subsequently died. The three main causes of death after this latter mistake are the oncoming of intracranial hæmorrhage, spreading œdema, or meningitis.

We shall consider : (1) *The mortality of various head injuries* ; (2) *The material for giving a prognosis in particular cases* ; and (3) *The possible sequelæ*.

1. Mortality of Head Injuries.—It is of no value to quote hospital statistics of mortality amongst head injuries in general, because practice differs so much as to what type of case is admitted and what sent away. A few well-defined groups, however, furnish valuable information. We have figures for the death-rate in cases of fractured base, fractured vertex, and extradural hæmorrhage.

Rawling's cases are taken from the records of St. Bartholomew's Hospital, Anderson's from the Cook County Hospital, and Bowen's from those of Guy's Hospital.

MORTALITY OF HEAD INJURIES.

Nature of injury, and reporter				Cases	Deaths	Mortality
						per cent
Fractured base	-	-	Phelps	286	176	61
			Rawling	205	89	44
			Battle	168	54	32
			Anderson	58	33	57
Fractured vertex	-	-	Phelps	116	41	34
			Rawling	88	29	37
			Anderson	72	46	64
Extradural hæmorrhage with no brain injury	-	-	Bowen	36	14	38
			(with operation)	25	3	12
Extradural hæmorrhage with serious brain injury	-	-	Bowen	36	30	83
			(with operation)	26	20	77

It will be observed that the figures for fractured base vary ; in English practice the mortality is probably under 50 per cent. Fractured vertex is less dangerous ; about one-third die. Of 51 cases of extradural hæmorrhage treated by operation, 23 died, that is, less than half. Out of 137 cases of pistol-shot of the brain reported in a New York newspaper for one year, 6 recovered after operation. (For gunshot wounds of the head, see GUNSHOT WOUNDS.)

2. Data for Prognosis.—As above remarked, prognosis is absolutely impossible at the first time of seeing, unless the patient is obviously moribund ; and even if consciousness has not been lost, one dare not say that the injury is trivial. The great

majority of fatal cases die within forty-eight hours, and after a week has elapsed death is improbable; but even then there is a remote risk.

Unconsciousness.—The degree, depth, or prolongation of primary unconsciousness, taken apart from other signs, is of very small value in giving a prognosis. If other signs are favourable, recovery will almost certainly occur, even if the patient is still unconscious at the end of the third or fourth day or later (Phelps). Nor will such patients necessarily have grave after-symptoms, if properly treated.

On the other hand, recurring unconsciousness, after a more or less lucid interval, is of very grave import, denoting intracranial hæmorrhage; and apart from successful operation, as in cases of middle meningeal rupture, the patient will almost certainly die in a few hours or days.

The temperature is a sign of great value (Phelps). If it is very subnormal from the first, and shows no tendency to rise, the patient is likely to die outright of shock. Again, if at any time it rises rapidly, death is probable. Recovery never occurred in Phelps's cases when 105° was reached, and very few survived whose temperature rose above 104° .

A pulse which is slow and full, or very quick and feeble, is generally rather ominous; the former usually indicates cerebral compression.

Hemiplegia is a grave sign, if it comes on from the first; it makes it probable that the cerebral cortex is lacerated.

Depressed fracture of the skull is a much less grave injury in young children than in adults.

Escape of cerebrospinal fluid from one ear, in Rawling's cases, did not make the prognosis of fractured base worse; escape from both ears had a mortality of 66 per cent.

Septic complications render the death of the patient certain if the meninges are involved or a subcranial abscess forms, and therefore all cases with an open wound communicating with a fractured skull are in danger for a week or more.

Late deaths are due to sepsis in most instances, but it is extraordinary how long a person may live with a hæmorrhage which eventually proves fatal. Two cases have come under the writer's notice in which the patients remained in a variable, but rather stupefied, condition for more than a month after an injury, to the occiput in the one, and to the spine in the other—each dying at last of intracranial hæmorrhage, apparently dating from the time of the accident, and not repeated since. Sometimes, however, the original hæmorrhage appears to have been small, and to have given rise to a patch of softening which eventually becomes the site of a larger and fatal hæmorrhage. These cases have been called 'late traumatic apoplexy'.

Concussion.—A few autopsies on men and animals have been recorded showing that it is possible for death to result from simple concussion, without any signs of injury post mortem.

3. Eventual Results of Head Injuries.—Within a few days of the accident, the condition called *cerebral irritation* may come on, in severe cases, and last for a week or two. Such patients are likely to suffer from prolonged and severe functional defects.

Nerve injuries associated with a fractured bone may be immediate or remote; in either case they usually clear up. Those cases in which the paralysis does not appear for a few days, are always well in two or three months; in a few of the nerve injuries seen immediately after the accident, the lesion is permanent. The nerves most commonly involved are the second, seventh, and eighth.

A rare sequela of head injury is rupture of the internal carotid artery into the cavernous sinus, causing *pulsating exophthalmos*. Another rare injury is *traumatic cephalhydrocele*.

Functional defects of the brain are the most important sequelæ of a head injury. It is well known that persistent headache or neuralgia, vertigo, loss of memory, mental enfeeblement, or traumatic epilepsy may follow such an injury, and may persecute the patient for the rest of his life. Sometimes he becomes very sensitive to the effects of a hot sun, or easily upset by a little alcohol.

Crisp English followed up a number of cases of head injury treated at St. George's

Hospital, and obtained the following results, with which the statistics of Rawling closely agree.

	No effects	Slight	Marked effects
In 100 cases of fractured skull - - - - -	31	50	19
In 100 cases of concussion, compression, laceration -	48	42	10

In the fracture series, 52 out of 86 were earning their old wages, 6 were totally disabled, and the rest partially. In the second series, 63 out of 78 earned their old wages, 3 were totally disabled, and the rest partially. The old and the young suffered most.

These unfortunate end-results can be averted to a large extent by proper treatment at the time of the original injury. Patients, especially of the hospital class, are usually allowed to go back to work too soon. Every case of head injury ought to be kept quiet in bed on fluid diet until the dazed look of the face has passed off, the blood-pressure has risen to normal, and the patient does not sweat, or become giddy, on attempting to get up. After a prolonged unconsciousness, lasting hours, the patient ought to lead a quiet life for many months. These conditions being observed, even severe head injuries seldom leave any permanent trouble. It is perhaps wise to decompress for symptoms of cerebral irritation lasting six or seven days. Rawling quotes good results following decompression for long-continued post-traumatic headache, especially in war cases.

Traumatic Epilepsy.—In most cases, this is evidence of some organic lesion, such as a depressed fracture, scar in the meninges, old blood-clot, or tear of the cortex, but sometimes nothing can be found. The results of operation are not very successful; if a definite cause can be removed the outlook is better. Much depends upon keeping the patient absolutely quiet for months after the operation. Rawling records 20 cases of his own, of which 2 were cured, 14 markedly improved, and 4 not improved. Cushing gives figures as follows: free from attacks, 12; attacks less frequent, 30; no improvement, 17; died of status epilepticus, 2.

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HEART, AFFECTIONS OF.—(See ANGINA PECTORIS; CARDIAC SYPHILIS; ENDOCARDITIS, ULCERATIVE; HEART, CHRONIC VALVULAR DISEASE OF; HEART, CONGENITAL MALFORMATIONS OF; HEART, IRRITABLE; MYOCARDIUM, PRIMARY DISEASE OF; PERICARDITIS; PULSE, IRREGULARITIES OF; RHEUMATIC PERI-, MYO- AND ENDOCARDITIS.)

HEART, CHRONIC VALVULAR DISEASE OF.—The outlook in chronic valvular disease is notoriously obscure, and the new light which is breaking in hardly warrants didactic statements. Recent work teaches us that it is a misconception to regard a lesion of the valves as constituting a true morbid entity. The three great causes of valvular disease—rheumatic infection, syphilis, and atheroma—whenever they injure the valves, damage the even more important myocardium at the same time. In a few years from now we shall speak of cardiac rheumatism or cardiac syphilis as the disease, and mitral obstruction and aortic insufficiency as symptoms, or at most phases, of those diseases. A book of this kind is, however, not the place for introducing a sweeping change of terminology, and the more usual plan of dividing valvular diseases along anatomical lines will be followed. Even so, however, it soon proves impossible to exclude etiological considerations.

Mitral Regurgitation, for instance, is notoriously a symptom which it is customary to treat of as if it were a disease. The available evidence teaches that generally, if not always, it is myocardial and not endocardial disease that makes the mitral valve incompetent. Stiffening of the mitral cusps causes obstruction, not incompetence; myocardial disease promotes stretching of the mitral ring to the point at which it becomes incompetent. The course of the mitral defect is therefore in the main that of the myocardial lesion that is responsible for it.

The diagnosis of mitral incompetence rests on the presence of a systolic bruit at the apex, providing the possibility of the latter having an exocardiac origin has been excluded. What does the discovery of this murmur portend? As we have already seen, mitral regurgitation is one result of myocardial atony; with one important exception, to be mentioned presently, this is its whole significance. Clearly, then, we have first to ask

ourselves what is the morbid process that is injuring the muscular walls of the heart and making them atonic. In many cases it is, of course, some temporary anæmia or toxæmia of the whole economy, such as chlorosis or pernicious anæmia on the one hand, or diphtheria or typhoid fever on the other, that is attacking the myocardium among other organs. Here the prognostic import of mitral incompetency is small; since it furnishes some proof that the heart is attacked, it cannot be said to have no importance whatever; but the fact that there is a mitral systolic murmur adds nothing at all to the gravity of the prognosis. If in diseases of this general kind the patient's death is to be through his heart, it will not be because the mitral ring is so weakened that the valve leaks; it will be because the more important function of contractility is impaired, and experience teaches that atony of the mitral ring, as revealed by the mitral regurgitant murmur, is no index of interference with contractility.

When we come to those diseases in which the heart is picked out for attack by the morbid process (syphilis, alcoholism, arteriosclerosis)—processes, too, which last till and tend towards death—a little more weight attaches to the presence of mitral incompetence. As in the group of conditions considered above, it is one more proof of the fact that the heart is really injured. But a greater importance than this is often claimed for the mitral regurgitant murmur. It is said—Here is a heart that from now onwards has to bear the disadvantages of a mitral valve that does not allow the left auricle and its tributary pulmonary veins to be drained. These drawbacks are alleged to be imperfect aeration of the blood passing through the lesser circuit, and extra work for the right heart. These ideas are worth considering: if, in a case of chronic myocardial disease belonging to any of the types named above, there be found a mitral regurgitant murmur, it does imply some liability to pulmonary stasis; and if the second sound at the pulmonic cartilage be accentuated, this liability is probably being incurred. In fact, it is not too much to say that the best way of measuring the amount of stress imposed on the lesser circuit by mitral leakage is by observation of the degree of accentuation of the pulmonary second sound. Over against the evils attendant on the mitral defect in such a case there are, on the other hand, certain considerations which suggest that the supervention of mitral regurgitation may give actual relief where, as in many cases of chronic myocardial disease, the contractile power of the left ventricle seems to be giving out. Under such circumstances the fact that a little blood leaks back into the left auricle is no doubt bad for the pulmonary system; but the harm done in this way is balanced by the relief afforded to the wearing-out ventricle, in that its systolic task is a little lightened. In all such cases as these, the prognosis is really that of the disease itself; the mitral leak is but one, and by no means the most important, feature.

We said above that, with one reservation, mitral regurgitation is an expression of myocardial atony and no more. This one reservation has to be made in regard to mitral disease due to rheumatism of the heart. Here the mitral apparatus is doubly afflicted: the myocardial lesions, which always occur in every case of active carditis, and often persist when the acute phenomena have died down, favour stretching of the ring, while in practically every case each of the recurring phases of active infection adds something to the inflammatory fibrosis of the mitral curtains—a fibrosis which, once established, never disappears. The active phases are more or less limited to the first twenty years of life; the lesions of the valves and pericardium that are established during these years remain, while the myocardial lesions recover to a variable degree.

So far as the mitral regurgitant bruit is concerned, then, we have to find out to what extent it points to muscular damage that will pass away, and to what extent to valvular fibrosis that will tend to get worse. In the writer's view, the myocardial factor in rheumatic mitral incompetence is far more important than the endocardial; this view is chiefly based on post-mortem evidence. It is, however, probable that the more stiffened the mitral curtains, the louder and harsher the mitral murmur. It is further true that the presence and persistence of this murmur are evidence of the presence and persistence of organic disease of the heart. Kemp's inquiry into the subsequent course of the cardiac complications of acute rheumatism showed that the mitral systolic bruit which is so prominent a characteristic of such attacks disappears during or after convalescence in about one-third of the cases. The writer's experience is roughly confirmatory of this; but it also shows that a bruit which has persisted for a year after it was first established

is not likely to clear up. The great hindrances to the disappearance of this bruit are recurrent attacks of rheumatic carditis (in children, so often overlooked at the time) and inadequate care after obvious attacks have occurred. The latter point is responsible for the very definite contrast that exists between the behaviour of the convalescent rheumatic heart in children of the hospital class and in those who are more happily circumstanced. The former point is probably responsible for the fact that in adults, whose attacks of rheumatism are more likely to be articular than in children, and who are less liable to relapse, a permanent systolic murmur is not such a common feature as it is in the rheumatic child. Even in cases where the apical systolic bruit has disappeared, it is well to remember that the patient is not yet out of the wood. Either with or without obvious relapse, it may reappear, or a presystolic murmur may develop. Prolonged absence of all signs of mitral regurgitation does not prove that the mitral curtains are normal; a process of inflammatory sclerosis may be going forward through a stage of latency to the point at which it causes signs of obstruction.

As for the actual harm which mitral regurgitation of rheumatic origin does to the rest of the heart, this is slight compared with the other lesions of the heart which are present in any case of rheumatic heart disease with signs of mitral reflux. It is true that in these cases the pulmonic second sound is nearly always unusually emphatic, but this must not be ascribed solely to the effect of mitral insufficiency in raising the tension in the lesser circuit; the fact that the *conus arteriosus dexter* is uncovered is of equal importance, as it brings the diastolic snap of the pulmonary valves nearer to the observer. The importance of the signs of mitral leakage is indirect; their presence proves that the heart has been injured by the rheumatic infection, and their persistence proves that those injuries have not disappeared, and that there is still a likelihood of permanent cardiac disablement. The harsher the murmur, the greater the probability of this persistent type of disease; but even in those cases where a loud, harsh systolic murmur at the apex persists into adult life, it is of more importance to note the size of the ventricles and to estimate their functional efficiency than to bother oneself unduly about the intensity and line of spread of the apical bruit.

To sum up: Mitral regurgitation is a symptom of various disorders and diseases of the heart, and not a disease of itself. Its prognostic significance lies in the light which it throws on the course of the underlying condition.

Mitral Stenosis, on the other hand, is a distinct clinical and pathological entity. The cases that usually bear this label are in reality cases of rheumatic heart disease that have escaped the earlier dangers of the disease and its complications, and have survived into the residual or terminal stage. There are certain fundamental facts on a realization of which prognosis must rest.

1. Recovery is impossible. The fibrotic deformity of the curtains, the essential fact of the disease, cannot be caused to disappear by any means in our power. As they are, so they will remain to the end. Prognosis is therefore concerned solely with questions as to the patient's chances of survival.

2. The average age at death in a series of 35 cases of pure mitral stenosis examined post mortem at the Bristol General Hospital was 39.2. Probably this figure is low: an undue proportion of patients with acute reinfection, as well as of those exposed to abnormal stress, is sure to be included in a hospital series. In 6 cases there was evidence of recent rheumatic inflammation of the heart in addition to the mitral stenosis; in this series the average age at death was 30, while in 8 cases in which the scarred mitral valves had become the seat of an ulcerative endocarditis the average age at death was 31. The average age in the first class would probably be lower if one were able to include those cases in which fresh rheumatic infection has occurred but without producing any gross naked-eye change. In such, microscopical examination discovers signs of acute myocarditis. Post-mortem data therefore show that (a) Mitral stenosis shortens life by twenty to thirty years; (b) The mechanical effects of the lesion are responsible for the end in a majority of cases; (c) Two complications, fresh rheumatic infection and ulcerative endocarditis, occur in a minority, bringing about a fatal termination earlier by a decade than would have been the case otherwise.

3. The average age of the onset of symptoms, in those cases where it has been possible to inquire into this rather vague point, has been 26. From this it seems that

the average expectation of life from the onset of symptoms is about 13 years. The actual date at which the cardiac lesion is first established cannot be ascertained in a vast majority of cases. The rheumatic process is so insidious in its beginnings that these usually go undetected. It is, however, certain, from those cases that can be studied from the beginning, that the foundations of the valvular lesion are laid in nearly every instance before the age of 16.

4. There is, then, a prodromal stage during which the mitral orifice is becoming narrowed. How can this narrowing be foretold? In any given case of rheumatic carditis the signs most distinctly indicative of stiffening of the mitral cusps are persistent harshness and loudness of the systolic apical murmur, if one be present; sharp accentuation of the first sound at the apex; doubling of the second sound at the apex, if that doubling be constant and definite; and the existence of a constant mid-diastolic bruit at the apex. If these phenomena persist for months, uninfluenced by rest, one is justified in most instances in regarding the case as on the road to mitral stenosis.

Once established, the course of mitral stenosis is towards cardiac failure. As we have seen, this end may be forestalled by other happenings. The sclerosed, vascularized valve may become the home of other organisms, and the supervention of any blood infection, such as pneumonia or puerperal septicæmia, is more to be feared in the subject of chronic mitral disease than in others. Actual evidences of ulcerative endocarditis—petechiæ, wasting, hæmaturia, enlargement of the spleen, fever, and so on—should never be forgotten in the examination of cases of chronic mitral obstruction. If signs of this complication are found, the outlook is hopeless; death is probable within the year (*see* ENDOCARDITIS, ULCERATIVE). The supervention of a fresh attack of rheumatic carditis is not so immediately dangerous. In the presence of polyarthritides, or chorea, or subcutaneous nodes, one should look out for pericarditis, dilatation of the heart, or fever persisting after subsidence of the outward and visible evidences of active rheumatic infection. These indicate fresh carditis, inevitable results of which are temporary impairment of the myocardium and permanent addition to the mitral fibrosis. For these two reasons rheumatic reinfection of the patient with mitral stenosis must always be regarded with respect; every such attack tends to shorten the patient's life.

One other accident may intervene to accelerate the patient's gradual progress to the grave—that of cerebral embolism. This occurs in a small number of cases; Bradshaw found that 6 out of 77 cases of mitral stenosis ended so. Apart from the symptoms that point to embolism of other organs, no warning is given of this calamity. It rarely occurs except in persons with marked evidence of circulatory embarrassment, save when it is due to malignant endocarditis engrafted on the fibrotic lesion. The presence or absence of symptoms of active infection will serve to distinguish between the embolism that arises from this cause, and that which is due to detachment of clot from the mass in the left auricle. In the latter case, if the end is to be fatal it comes at once; in the former, the immediate shock of the embolism may pass away, and yet death may follow after a short interval from the later effects of the infection of the interior of the skull which is implied in an embolism of this type. In either case the majority of cases of cerebral embolism complicating mitral stenosis do not end abruptly. The non-infective embolus that fails to kill establishes a hemiplegia which is never completely recovered from.

In a large majority of all cases of mitral stenosis death is due to gradual cardiac failure. The forces responsible for this are two. The heart, and especially the left auricle, is asked to do more work by reason of the valvular obstruction; and gradually increasing venous stasis undermines the nutrition of the cardiac, and particularly the auricular, musculature. An unconquerable vicious circle is thus established. The results are pulmonary engorgement, auricular breakdown, and ultimate ventricular failure. The first of these threatens death by predisposing to bronchitis, suffocative œdema, and multiple infarction of the lungs; and for these reasons dullness at the bases, signs of bronchial and alveolar catarrh, and hæmoptysis are bad features of the case. Auricular failure can only kill in so far as it predisposes to the other fatal factors; that it lends itself to pulmonary hyperæmia is obvious, but it is not always realized how much the importance of auricular breakdown lies in its capacity for vexing the ventricles. The auricular contraction is not a vital function—the circulation can go on without it, for

ventricular diastole will drain the auricles ; but ventricular systole must go on, for if it stops, life stops too. Now, auricular failure contributes to the ultimate downfall of the ventricular function in two ways. The overworked, underfed auricle goes into fibrillation ; instead of handing down a regular series of stimuli to the ventricle at the rate of, say, 80 to the minute, it pours down stimuli into the ventricle in a disorderly and incessant stream, which escape into the latter chamber as fast as the auriculo-ventricular connections will transmit them. The result is that the ventricle is stimulated to contract more often than is necessary, and in so disorderly a fashion that contractile substance cannot be built up on the ordinary rhythmic plan—a fact which cannot but indicate some waste of energy. Left auricular asystole also adds directly to the work of the right ventricle, and thus increases the probability of its failure. It also helps to overthrow the ventricular functions by increasing venous stasis, and so damaging the nutrition of the ventricular musculature.

There are thus three things to take note of if we are seeking to ascertain how near the patient is to auricular, and thence to ventricular, breakdown : (1) *Pitch of stasis* ; (2) *Condition of auricles* ; (3) *Condition of ventricles*.

1. *Pitch of Stasis* is to be measured by certain symptoms : dyspnœa and cyanosis afford our best means of measuring it in the earlier stages ; later we may be guided also by the total daily output of urine, the presence or absence of hepatic enlargement, the size of the veins in the neck, and the occurrence of œdema (though this is usually a late feature of mitral stenosis).

2. *The Condition of the Auricles* may be judged from data bearing on (a) their size, (b) their functional integrity.

a. Increase in the size of the auricles is a bad feature of mitral stenosis as far as it goes, but it matters less than the more positive and direct evidences of impaired function. Dilatation of the right auricle is indicated by dullness filling in the cardio-hepatic angle ; skiagraphy is also of service, and it is even more so in the examination of the deep and inaccessible left auricle. The pressure signs that may arise from extreme dilatation of the left auricle (left recurrent laryngeal palsy, dysphagia, etc.) are all of serious prognostic import.

b. The signs of the previous class are less frequent and less ready to hand than the evidences of impaired auricular function. By far the most important of these is the totally irregular pulse, which is a constant feature of auricular fibrillation. The reasons why this upset of rhythm is bad for the heart's working have been stated above, but it must be remembered that the inception of this form of arrhythmia marks two things : the arrival of the auricle at an advanced stage of degeneration, and the addition of a new disability to the disadvantages under which the ventricles are working. In 26 cases under the writer's care the average age at which this form of arrhythmia was first detected was about forty, a little in excess, that is to say, of the average age at death in these cases. This proves that the totally irregular pulse—or rather, the fibrillation which underlies it—is a terminal phase in those cases of mitral stenosis that have escaped the more summary modes of termination. The patient may live on for years, if he is careful, after this has developed ; in rare instances he may even be able to go to work and lead a fairly active life ; but it will be on condition that he remains in the doctor's hands and submits to his advice for the rest of his days. Total arrhythmia nearly always marks the beginning of total invalidism. The expectation of life from its onset varies from a few months to ten years, or even longer in very fortunate cases, the average expectation being about five years. The factors making for long life in such circumstances are a good ventricle and a quiet life. Temperament also plays a part in patients who have reached this phase of mitral stenosis ; how, it is difficult to explain, but people who face their trouble with a sanguine courage can certainly accomplish more than the less stout-hearted, though apparently without suffering for it in shortening of life.

The other evidences of auricular failure are as a rule masked by this very striking arrhythmia ; nevertheless, they may be found if they are looked for, and they are not without importance, since they may foreshadow the onset of fibrillation. Decrease in intensity of a previously loud presystolic murmur, and lessening of the *a* wave as compared with the *c* wave in the jugular curve, both show that the auricular systole is becoming less effective. With the onset of total arrhythmia, both murmur and *a* wave disappear

entirely. In cases of mitral stenosis of long standing, with much dyspnoea and cyanosis, the appearance of many auricular extrasystoles in the pulse curves is often a forewarning of imminent fibrillation.

3. *The Condition of the Ventricles.*—Ventricular failure is likely to occur earlier in patients with dilatation of the ventricle, in those who have chronic bronchitis, in persons with high arterial tension (not an uncommon accompaniment of mitral stenosis), and in those who are prevented from giving themselves a due amount of rest.

The last phase is one of intense hyperæmia of the lungs, with or without infarction; to this stasis, failure of *vis a tergo*, as well as increased resistance in front, is contributory. Two symptoms that may appear at this late stage are worthy of separate mention in regard to prognosis—hæmoptysis and vomiting. The former is never fatal of itself, and its significance differs in different cases. There is a constant slight weeping from the lung which does not betoken dangerous pulmonary congestion; it comes on early in the case, and may continue intermittently for weeks. There is, on the other hand, a more acute and intense type of hæmoptysis which, if accompanied by respiratory embarrassment and even by pain in the chest, points to the occurrence of infarction. This is evidence of a more serious state of affairs, and death may follow soon. But people never bleed to death from the lungs in mitral stenosis, nor do they drown in their own blood as in tuberculous hæmoptysis. Vomiting may be ceaseless and intractable in this last stage of the disease; it may even kill the patient.

One final cause of death in mitral stenosis, rare indeed but yet worth bearing in mind, is cerebral hæmorrhage. The reason lies in the association that sometimes exists between mitral stenosis and granular kidney, and the consequent occasional association between mitral stenosis and high tension. It is a rare coincidence, yet so important that the possibility of its occurrence should not be overlooked.

The risks of sudden death in mitral stenosis are small. The cerebral lesions, embolism and hæmorrhage, are possible causes, and the writer has known at least one death in early mitral stenosis which occurred without warning. Possibly this was due to recurrent acute carditis, but there was no autopsy. At any rate, sudden death from cardiac failure is so rare in mitral stenosis that patients may be assured that the risk is almost non-existent.

As for the effect of treatment on the prognosis, the most conspicuous benefit to be derived is that which those enjoy who can and will consent to limit their activities. With regard to the amount of activity that may be safely allowed, there is of course no fixed rule; but the patient may, if he must, be allowed to undertake such work as does not cause him to become breathless. He will be better off earning a little money than starving in idleness. The nation is at present wasting some of its valuable man-power because it has made no provision for fitting these 'cardiac cripples' with productive tasks.

Women do a little better than men, and if their circumstances are comfortable and easy they do better than those who are compelled by want of help to do heavy housework and to undertake personal responsibility for large families. Pregnancy makes the symptoms worse for the time being, and introduces a small risk of reawakening of the rheumatic infection. French and Hicks found that in only 28 per cent of a large series of cases of mitral stenosis in married women was there any direct relation between pregnancy and heart failure; and in nearly all of these it took several pregnancies to bring on symptoms. It is only in extreme cases that the patient has to be prematurely delivered on account of the aggravating effect of pregnancy on the symptoms. In such cases as require this extreme step, its consequences are often disappointingly small, the patient being but little relieved; but on the other hand, the patient suffers no ill consequences from the strain of parturition, whether it be normal or induced, providing it be not unduly protracted; or perhaps it would be more correct to say that the ill-effects of that strain are more than counterbalanced by the relief afforded by the emptying of the uterus and the removal of the impediment to breathing which the full uterus offers. In French and Hicks's cases there was no single example of death during labour, and in only 14 per cent of those whose symptoms of heart failure began during pregnancy, did the woman die within three months of delivery; and the percentage of abortions was even smaller (5.5 per cent).

Of other points regarding treatment in its effect on prognosis, there is all too little

to be said. The future hope in mitral stenosis lies in prevention and not in treatment. One observation is worth attention—the remarkable benefit experienced from the use of digitalis in full doses by patients with mitral stenosis and total arrhythmia. Armed with this drug, and after a period of complete rest, patients recover and retain their capacity for work in a most gratifying way. If this line of treatment—rest and digitalis—fails in a week to slow the pulse and alleviate the dyspnoea and other symptoms, in a case of mitral stenosis with total arrhythmia, the patient is in a hopeless case and cannot survive long. If, however, the treatment gives relief, it is probable that he will regain to some small extent his capacity for getting about and even for work; though, as we have already remarked, he will still have to regard himself as in need of continued medical care.

Patients who are urgently dyspnoeic, blue, and dropsical, are sometimes relieved to an astonishing extent by venesection, a procedure which seems to give cardiac tonics a better chance of helping the patient, as well as affording direct relief. Leeching may have a similar effect. The value of opium in giving the patient rest may also be mentioned.

The outlook in mitral stenosis is discovered, therefore, by assessing its effects on the functions of the rest of the circulatory apparatus, especially the left auricle and the lesser circulation.

Aortic Regurgitation is the outcome of several morbid processes, which may act together but much more often operate singly. The prognosis varies widely according to the causation. This is chiefly because different causes affect the myocardium in varying degree. Syphilis injures it profoundly and progressively; arteriosclerosis as progressively, but less profoundly and rapidly; rheumatism attacks the myocardium severely, but for the most part its effects are transient, though liable to repetition. The prognosis in any given case exhibiting the signs and symptoms of aortic regurgitation depends also on the degree to which the valves are injured, and the extent of the secondary effects of these injuries on the general efficiency of the circulatory apparatus.

In the syphilitic cases the expectation of life from the onset of symptoms is about five years, if we exclude cases in which syphilitic infection of the aorta has led to the formation of an aneurysm as well as to valvular disease. In cases of the latter type the prognosis is even worse.

In the rheumatic cases the prognosis is much better. This is not seen so well in mere averages of duration of life after onset of symptoms and the like, as in a consideration of a few typical cases. Out of a group of seven fatal cases seen by the writer in recent years, the youngest died at 13 in an acute attack of carditis, in which the aortic lesion had little or no effect in bringing about the fatal issue; while the oldest was a man of 45, whose ventricular contractility had been failing for years. Of the rest, two died at 19 and 29 respectively, in what seemed to be an acute phase of rheumatic carditis; two others at 35 and 37 of ventricular failure, and the fifth at 29 of malignant endocarditis engrafted on the old valvular lesion. Thus the various risks of rheumatic disease of the aortic valves are exemplified: acute injury of the myocardium by recurrence of the acute infective process, progressive ventricular failure, and ulcerative endocarditis. This third risk is of course much less often encountered than the other two, so that those who are fortunate enough to escape at last from the years in which the rheumatic infection is active, and who are also able in later years to avoid ventricular overstrain, may look forward to a possibility of long life. The writer knows two members of the profession who live active and responsible lives in spite of rheumatic aortic incompetence borne in each case for a number of years.

A third ill-defined group consists of those cases in which the aortic incompetence is one aspect of a cardiosclerotic process of the senile or atheromatous type. When the syphilitic factor has been rigorously excluded, this class is probably a small one, and no statistics are available. Experience shows, however, that the course is slower than in the syphilitic cases, but more rapid than the rheumatic ones that have survived into the fourth and fifth decades.

The existence of a fourth type of aortic valvular disease, that due to progressive bacterial ulceration of the cusps, must not be forgotten. This morbid process may attack valves already imperfect by reason of previous rheumatic infection; or it may arise *de novo* from causes not yet understood. In either case the prognosis is bad. No known

remedy is effective, and the patient will not live more than two years from the onset of symptoms except in very unusual instances.

Turning to the clinical features of each individual case, we must find out, first, how badly the valves leak, and secondly, how well the heart bears its abnormal burden. As to the extent of valvular injury, the direct physical signs are of less value than those which point to the effects of the leak on the peripheral circulation. The loudness of the regurgitant murmur and the extent of the area over which it is heard teach us nothing as to the degree to which the valve is rendered incompetent: except in this indirect way, that if the bruit be heard loudest at or above the aortic cartilage there is most likely some dilatation of the aorta, and the prognosis is worse, since dilatation of the aorta belongs to the cases that are syphilitic in origin or severe in degree. The effect of the leak on the peripheral circulation is best measured by observing the pulse-pressure—i.e., the difference between the systolic and the diastolic pressure. For the sake of accuracy it is well to measure this with the sphygmomanometer in every case; but even where this is not immediately feasible, a rough estimate of the circulatory disability may be arrived at by noting the amount of visible pulsation, and especially the amount of visible capillary pulsation. The wider the swing between maximal (systolic) and minimal (diastolic) filling of the peripheral vessels, the greater the amount of reflux and the worse the prognosis. A similar conclusion is to be drawn from the prevalence of any of those symptoms (headache, dizziness, nose-bleeding, visual disturbances, etc.) that indicate unsteadiness in the supply of blood to the systemic organs; the more marked these are, the worse is the leak and the graver the prognosis.

Even more important than the state of the peripheral circulation, however, is the condition of the myocardium. How far is it able to meet this very direct and very considerable task that is thrust upon it? Here a knowledge of the etiology is indispensable, and it is especially important to ascertain whether or not there is a syphilitic factor. A search for evidences of cerebrospinal syphilis, and an examination of the blood by the Wassermann method, should not be forgotten here. The discovery of the syphilitic factor makes the prognosis worse, because it implies an attack on the myocardium by a progressive and practically invincible process. If the case be one of rheumatic disease of the aortic valves, the most serious risk to which the myocardium is exposed is that of re-invasion by the rheumatic process; this danger becomes less with advancing years, and after the age of thirty it is remote. Of the cardiosclerotic cases nothing need be said, but that the same morbid process that has led to calcification of the aortic valves is sure to interfere more or less with the nutrition of the cardiac wall, and to do so, though slowly, yet progressively.

Not only etiology, but also symptomatology, come under review in finding out what chance the left ventricle has of coping with the extra burden thrown on it by the failure of the aortic valves. In this form of valvular disease the danger-signals to be anticipated are those phenomena that point to exhaustion of ventricular contractility. There are three factors at work, the combined effects of which are sure to undermine the efficiency of the ventricular contractions in the long run: the myocardial lesions of the causal disease, which have just been discussed; the persistent overstress to which the ventricle is exposed by the valvular leak; and interference with the myocardial nutrition by the disturbance in the peripheral blood-supply, which tells on this as on every other systemic tissue. Failure of contractility is therefore probable in all cases except those in which the first of these factors, the etiological one, has done its worst in early life and become inoperative later—i.e., in the rheumatic cases. It is for this reason that cardiac pain, dyspnoea, and œdema—all of them evidences of failing contractile force—are of more significance than any physical signs in aortic disease of long standing. For the same reason the alternating pulse is a very grave sign in such cases. Among the physical signs, those which point to progressive increase in the size of the ventricle, and loss of strength in the first sound at the apex, are of most significance. Anything suggestive of gross myocardial change (coronary thrombosis or embolism, rupture of the heart, formation of a cardiac aneurysm) is of course of almost immediately fatal import. Rupture of a valve, on the other hand, though it adds at once to the patient's discomforts and disabilities, does not by any means always kill at once. The writer has recently seen two cases, in the one of which the man was alive and at work till about seven

years after the rupture seems to have occurred, while in the other a year had elapsed and the patient was still working. The opening which a sclerosed valve offers to the various organisms capable of setting up an ulcerative endocarditis needs not to be enlarged upon; the supervention of septicæmic symptoms in a case of chronic disease of the aortic cusps will readily suggest the appropriate diagnosis and prognosis (*see* ENDOCARDITIS, ULCERATIVE). The possibility of other lethal lesions should never be overlooked, especially in the syphilitic cases (aneurysm, cerebrospinal syphilis).

The liability to sudden death of persons carrying a leaking aortic valve is almost proverbial. Indeed, this risk has been rather over-emphasized. Yet when we consider the double attack to which the ventricle is exposed in this form of valvular disease—the direct injury of the myocardium that is inflicted by that which causes the valvular lesion, and the less direct effects of overstrain resulting from the incompetence of the valve—it is not to be wondered at that this should be, above all others, that lesion which best and oftenest exemplifies the disastrous effects of exhausted ventricular contractility. In the syphilitic cases, if those which are terminated by rupture of an aneurysmal sac be excluded, death comes suddenly in nearly 40 per cent; in the rheumatic cases, the writer had only two out of ten fatalities that could by any means be called sudden. Syphilis is more likely to cause sudden death than rheumatism, because of its more enduring and progressive interference with the nutrition of the myocardium. In many of the cases that end with unexpected abruptness, this catastrophe might have been foreseen and possibly averted if more weight had been given to the symptoms of failing contractility that were present.

As for the *effect of treatment*, the results of antisyphilitic measures call for brief comment. No definite improvement in cases of aortic valvular disease can yet be placed to the credit of salvarsan; and as it is generally acknowledged that in the presence of cardiac disease the use of this medicament is not entirely free from risk, it is best to rely on mercury and iodide, the prolonged use of which (and especially the former) does indubitably ameliorate symptoms, as much, no doubt, by its action on the myocardium as by any effect on the valvular lesion itself. In the rheumatic cases the establishment of a quiet way of life is amply justified by its results.

Complete cure is excessively unlikely, but it does occasionally come about. Signs disappear, and symptoms also. Possibly in such cases dilatation of the aortic ring has played an important part in rendering the valve incompetent, and its recovery of tone has restored its functional integrity to the valve. It is so unlikely and so unforeseeable that it cannot be looked for with any confidence, but the fact that it does occur, if it be borne in mind, will serve to colour one's view of the disease.

Lastly, it should be recollected that, despite its dangerous nature, and the variety of ways in which it may end life, the possession of an incompetent aortic valve is not incompatible with a long life. The writer has already given instances of this, and there are other remarkable examples scattered through the literature; one, for instance, in which a man, known at 13 to have aortic valvular disease, was carrying it with comparative comfort and freedom from symptoms at 66.

Aortic Stenosis presents three classes of cases to be considered. The first consists of those patients in whom the obstruction appears to develop slowly, the symptoms being first noticed at or about the age of 30, without obvious cause, apart from rheumatism in a few cases, and without accompanying signs of aortic regurgitation. This is a small group of cases, and the prognosis is nearly always bad; the patient rarely passes the age of 40. In a second group, the patient has already distinct evidences of aortic incompetence, when the signs of aortic obstruction become superadded. The result is a modification of the peripheral phenomena; the pulse loses its collapsing character, and so on. The effect on the prognosis in such cases is not as bad as one might assume at first sight, for the peripheral effects of the obstruction neutralize those of the regurgitation to some extent. Often the patient is actually more comfortable for the change. It is only in cases of severe valvular change that this sequence is encountered, so that the regurgitation is generally free and the symptoms are pronounced. The mitigation of the symptoms, which ensues upon the supervention of stenosis, affords the patient real relief, and delivers his ventricle from over-distention in diastole, thus diminishing the load which has to be lifted by each systole: so that, for the time at least, the heart's

work is eased. Of course, the ultimate prognosis is not good, but it is not so bad as in the first group. In the third group are collected those cases of stenosis developing slowly in persons of 50 or over, thanks to a gradual calcification of the aortic cusps. Here the morbid process is a very slow one, and though the coronary arteries may be damaged at the same time, the myocardium yields but slowly, and the patient may attain to old age.

In individual cases of aortic stenosis there are two things to be assessed—the degree of obstruction and the condition of the left ventricular myocardium. The former is determined by observation of the type of pulse rather than by the physical signs, though the prominence of the thrill and murmur must also be given some weight. The more characteristically flattened the pulse-wave, the worse for the patient. As for the state of the ventricular muscle, this is revealed by an examination of the functions; pain, dyspnoea, alternating pulse, and other evidences of failing contractility are ominous signs.

Treatment has little effect, even in the syphilitic cases.

Combined Aortic and Mitral Valvular Disease is encountered in two sets of cases. In the first the rheumatic inflammation which injured the one set of valves did the same by the other; in the second, ventricular dilatation, consequent on aortic insufficiency and diastolic overfilling, has stretched the mitral ring and made the valve incompetent. In the first class of case, the signs of mitral stenosis are added to indefinite evidences of aortic regurgitation; or it may be that the aortic lesion is pronounced and the mitral signs are vague; while in a few there are pronounced evidences of both. In any such case the gravity of the outlook is greater than in the presence of a single lesion, partly because the mechanical disabilities of the one lesion are added to those of the other, and partly because the presence of severe and widespread endocardial lesions in post-rheumatic heart disease argues the presence of diffuse and severe myocardial damage. In the second group of cases the supervention of mitral incompetence in an aortic case is evidence of severe embarrassment of the left ventricle, and therefore of bad omen.

Acquired Lesions of the Tricuspid Valve.—The prognosis in these lesions is based on the fact that they never occur alone.

Tricuspid Incompetence is so common that some writers regard it as one of the normal functions of the tricuspid apparatus to open out under stress and relieve a distended right ventricle by permitting a certain amount of back-flow into the distensible liver and venous system. Whether this is going rather far or not, evidence does not at present allow us to decide; but there are certain facts available. First, such diseases as mitral stenosis, cardiosclerosis, and chronic bronchitis with emphysema, diseases which encourage hyperæmia and stasis in the blood-channels that course through the lungs, lead at last to persistent over-stretching of the right auriculo-ventricular communication and render its valvular apparatus permanently incompetent. Second, the clinical evidences of this persistent incompetence are mainly those of venous stasis in the systemic circulation—big veins in the neck, enlargement of the liver, diminution in the output of urine, dropsy, and so on. Third, the more pronounced and persistent these symptoms, the worse the outlook; partly because the condition of venous stasis thus perpetuated undermines the nutrition and efficiency of various vital tissues, the myocardium itself among them, but also because the presence of extreme and permanent tricuspid failure proves the existence of a proportionately severe hindrance to the drainage of the lesser circuit into the left heart. The presence or absence of a tricuspid systolic murmur makes little or no difference to prognosis, at any rate as compared with the significance of the symptoms mentioned. In the first place, it is not easy to decide whether or no the bruit is tricuspid at all; in the second, the valve may be grossly incompetent without any murmur being audible.

Tricuspid stenosis, if acquired, is always the outcome of rheumatic carditis, and as such is little more than an unusual feature in a common type of case. The tricuspid curtains are found thickened and stiffened in a small percentage of cases of mitral stenosis coming to autopsy, but it is only in a very few of these that the presence of such a coincidence of lesions can be diagnosed. When the diagnosis can be made, the patient's prospects are a good deal worse than in an uncomplicated case of mitral stenosis. According to Newton Pitt's figures, the duration of symptoms does not usually exceed five years, and about half the cases fail to survive the age of 30. The liver pulsation,

sufficiently developed to yield a clear three-wave phlebogram, which has by some been regarded as a sign of tricuspid obstruction, is sometimes encountered apart from this condition; but even so, it is a valuable proof of advanced engorgement of the right auricle, and as such is a bad sign.

Acquired Pulmonary Lesions.—These are so rare that they may be quickly dismissed.

Pulmonary Stenosis is of course rarely diagnosed as an acquired lesion; it runs a short course, the length of which may best be gauged by observation of the state of the right ventricle. As in the corresponding congenital malformation, the patient is specially liable to contract, and die of, phthisis.

Pulmonary Regurgitation, due to inflammation of the pulmonic semilunar cusps, is a very rare lesion; the diagnosis is a bold one, but if it has been made it carries with it a bad prognosis. More common is that insufficiency of the pulmonary valves which may develop in advanced mitral stenosis as a result of the great rise of pressure in the pulmonary artery. It is extremely hard in many supposed cases of this condition to be sure that we are not dealing with that very frequent result of rheumatic carditis, aortic and mitral valvular disease combined; but if this can be excluded and the diagnosis of secondary pulmonary insufficiency substantiated, it may be regarded as a bad sign in a case of mitral stenosis. It proves the existence of a high degree of circulatory obstruction; and it also threatens overloading of the right ventricle. As a matter of fact, its prognostic importance is not as great as might be expected, for it is only in cases of mitral stenosis that are obviously advanced, that one ventures on a diagnosis of secondary pulmonary regurgitation.

In all cases of chronic valvular disease, and indeed of chronic cardiac disease of all kinds, we must remember that there is a very important question—possibly the most important of all our questions—to which an answer must be got in general terms. And that is, what margin of force has the heart in reserve for emergencies? Life is full of emergencies. For some patients the mere turning over in bed is enough to cause urgent distress; others can climb a flight of stairs without difficulty; and yet the physical signs in the former may not be very different from those in the latter. We must always remember therefore to get some definite idea as to the patient's capacity for effort. If it is not obvious on the face of things, we must seek for it by means of definite exercise tests. Ask him to walk up a flight of steps; or to repeat, half a dozen times, some simple form of physical drill; and watch the effect on his breathing and on his pulse-rate. This should be practically a universal rule in all cases of chronic heart disease; except, of course, those in whom dyspnoea is an obvious and a constant feature. Even in these it is well to inquire a little below the surface as to the cardiac reserves, by giving the patient a rest in bed and observing his reaction to it, before giving a definitely bad prognosis.

And it must also be remembered that a courageous patient gets on better than a fearful one. The habit of fear is katabolic in its effect, and the heart feels this as well as the rest of the body.

The general principles of prognosis may be briefly re-stated.

1. The valvular lesion is but a part of the picture; it is the observer's duty to discover as far as possible the state of the *whole* heart, and of all the organs.

2. The outlook depends ultimately on the balance struck between valvular disability and myocardial capacity. To what extent is the latter capable of rising to the occasion?

3. This question is best answered, speaking generally, by an intelligent exploration of the symptoms, and a search for evidences of myocardial exhaustion. *Carey F. Coombs.*

HEART, CONGENITAL MALFORMATIONS OF.—In forecasting the future of a child or young adult who has been found to suffer from a developmental fault of the heart, the questions that have to be answered are, *How long is he likely to live?* and *Is there any chance of a useful career for him?* It would be possible to answer these questions with considerably more precision and confidence if it were possible in every case to discover the actual nature of the malformation. Unfortunately, such detailed accuracy is out of reach in very many cases, so that one's prognosis is founded on a varying admixture of knowledge of the defect present and the average duration of life in such cases, with

observation of the symptoms as indices of the extent to which the efficient working of the heart is threatened by the disabilities imposed upon it by the errors in development.

Average Expectation of Life in Various Defects.—The following facts and figures are collected from the writings of Peacock, Maude Abbott, and others.

The lesion which is most readily, and therefore most often, diagnosed is pulmonary stenosis. Patients have been known to reach a good age with this defect, even after an active life. The writer recalls several such—a railway porter who at 23 was just beginning to be dyspnoëic, a cook who at 37 showed her first signs of broken compensation, and a lady of over 40 who leads a fairly active life. One case is on record in which the patient reached the age of 52. These, however, are the exceptions. The average age at death in pulmonary stenosis is 9 and in pulmonary atresia 3.

The co-existence of other lesions is a matter of some weight. Of cases in which an autopsy has been made, 56 per cent of those in which there was no associated defect of other parts of the heart ended fatally within the first two decades of life; of those in which pulmonary stenosis was coincident with a defective auricular but a perfect ventricular septum, the percentage was almost the same; of those in which there was an associated defect of the ventricular but none of the auricular septum, only 9 per cent survived the age of 20; and of those in whom there were faults in both septa, none passed that age.

Patency of the foramen ovale, without other defect, is a common and unimportant fault, but it is rarely diagnosed, so that we are thus deprived of the pleasure we might otherwise enjoy of giving a favourable prognosis in the great majority of these cases. Patients with this fault have lived a normal life without knowing that there was anything wrong with them. The same is probably true of limited defects of the septum ventriculorum; and since this is more readily detected it offers some small scope for the exercise of optimism, if one can be sure that no other defect of a more serious nature co-exists. Even when the septal faults are extreme and the heart is three-chambered, middle life may be reached.

Of the other defects, congenital atresia of the tricuspid valve is apparently incompatible with survival beyond the first year of life. Only one-seventh of the cases in which a transposition of the great arterial trunks was found post mortem had passed the age of five. Patency of the ductus arteriosus, if uncomplicated by other deformities, is compatible with the attainment of middle life and fair activity.

Coarctation of the aorta may remain latent throughout a normal life, being discovered only at the autopsy. Of the cases verified post mortem, 14 per cent passed the age of 50. The gross defects of position, those in which the heart lies exposed owing to a thoracic defect, are incompatible with more than a few days of extra-uterine life, though one case is described in which life was apparently maintained for a few days by the expedient of oiling the heart every three hours. Transposition of the heart, on the other hand, makes no difference whatever to the subject's expectation of life, and the heart may even lie within the abdomen, as in Deschamps' famous soldier, without being seriously incommoded.

Significance of Symptoms.—There are two chief ways in which a malformation of the heart may be responsible for the patient's death: cardiac failure and intercurrent infections. The patient's liability to the former is directly dependent on the extent to which the cardiac defect embarrasses his systolic efficiency; and in cases where the fault is on the right side of the heart, as it is in the great majority, this may roughly be measured by the degree of interference with the oxygenation of the blood. Thus, the more cyanosed the patient is, the worse the prognosis; and the same generalization holds good for other evidences of imperfect aeration, such as clubbing of the fingers, dyspnoea, stunted growth, and polycythæmia.

Of the intercurrent infections to which these unfortunate persons are prone, the most important are malignant endocarditis and certain pulmonary infections (tuberculosis and bronchopneumonia). The malformed heart seems to offer a ready home for streptococci and other organisms concerned in the production of ulcers of the endocardium; and though there is some evidence that acute inflammatory lesions of the developmentally crippled heart may recover, it must be acknowledged that this is a very remote possibility. Consequently, anyone with a congenital heart lesion who presents the symptoms

and signs of acute blood infection, with or without evidences of embolism, is in a bad way. The vulnerability to tuberculosis is greater in those patients who have survived the first decade; when contracted it runs a rapid course. The risk of this and the other pulmonary infections is of course increased if the patient's circumstances do not admit of his living a protected and sheltered life.

Among the causes of death in cases of congenital heart disease, the possible importance of associated malformation in other organs must not be quite lost sight of. One of the writer's patients had pulmonary stenosis and Mongolian idiocy, but death was apparently due to the toxic effects of a congenital dilatation of the colon.

Sudden death is not a very common event in congenital heart disease, but cases of all kinds may end thus. It is impossible to lay down any rules for the foretelling of such an event; and with a malady which is already so crippling to the patient's usefulness, it is probably better to say nothing about it. In patients with a patency of the inter-ventricular septum and drainage of both ventricles by one arterial trunk, sudden attacks of dyspnoea and cyanosis are apt to cause great alarm; here it is possible to assure relatives that avoidance of the provocative factor (which is usually easy to discern) will ward off further attacks.

To sum up, the prognosis in congenital cardiac defect is arrived at by making a diagnosis of the actual condition present as far as possible, and by filling in the gaps by assessment of the degree of cardiac embarrassment as revealed by the symptoms.

Carey F. Coombs.

HEART, IRRITABLE.—The war brought this syndrome into a prominence it had not hitherto possessed, not only because of its wide incidence among serving soldiers, but also because among the civil population, exposed as they were to unwonted mental and physical stress, the number of cases was in excess of the usual rate. The end of the war has not brought the relief from anxiety that was expected, and the irritable heart syndrome is therefore still with us.

The prognosis as to *ultimate recovery* depends on a variety of circumstances, but principally on the etiology of the syndrome in each particular victim. There are many persons who are doomed by temperament to acquire such disturbances of visceral action, especially in these troublous times, and these are less likely to lose their symptoms than are those persons whose disorder can be traced—as so often it can—to some definite emotional stress. Usually this is of the repressed anxiety type; the patient has some secret fear or shame; and if this can be discovered and removed by appropriate advice, there is a good chance that the cardiac symptoms will disappear. If it should prove that an infective cause can be discovered, the prognosis is naturally that of the causal infection. The longer the duration of symptoms before treatment begins, the worse the outlook. And recovery is less likely in elderly than in young patients. My colleague, Dr. C. E. K. Herapath, tells me that in his Ministry of Pensions clinic men up to thirty recover; men over forty do not; while those between thirty and forty may or may not get well. Broadly, a good 'exercise tolerance' is a good sign. Let the patient be tested by systematic exercise, and let it be noted whether this causes dyspnoea or pulse acceleration; and if the latter, whether the rate returns to normal within one or two minutes after the cessation of the exercise. If it does, the outlook is good.

Treatment influences the prognosis. The plan that will without doubt make the patient worse is to tell him there is something the matter with his heart and to put him to bed. If, on the other hand, he is told that it is not his heart that is wrong but its nervous control that is upset for the time being, and is advised to practise systematic and increasing physical exercise, he will stand the best chance of getting well. In compensation cases the settlement by a lump sum payment often helps towards recovery by solving the patient's anxieties as to what he is going to get, instead of keeping him perpetually on tenterhooks.

With regard to prognosis as to *length of life*, it is too early to say whether persistent nervous tachycardia is going to bring about premature cardiovascular degeneration. It has been asserted that this was so after the Balkan War, but whether this can be accepted or not depends on a rather more exhaustive examination of the evidence than has been possible hitherto.

There is no doubt that the supervention of the irritable heart syndrome in a case of

already existing organic lesions of the heart enhances the gravity of the outlook. Elderly men with degeneration of the ventricular walls may be hurried downhill by the effects of emotional stress on the cardiac control.

Carey F. Coombs.

HEART, SYPHILIS OF.—(See CARDIAC SYPHILIS.)

HEART, WOUNDS OF.—Until Rehn, of Frankfurt, in 1897, published his classical and successful case of suture of a wound of the heart, the injury was regarded as mortal, and treatment was in the clouds. To-day there are scores of recoveries on record. In England, where the promiscuous use of the knife as a means of settling quarrels is not so common as on the Continent, the published cases are very few, and the writer is only aware of one success (Somerville).

No doubt the immense majority of cases of wound of the heart are fatal within a few minutes, if not instantly, and this is especially true of gunshot wounds. Even when thus produced, however, death may be delayed. In the very desk on which this is being written there reposes a pistol used by a suicide to shoot himself through the ventricle (verified at autopsy); as this did not have the desired effect, he afterwards turned the weapon upon his temple, and died of a pistol-shot through the brain.

The cause of death in stab-wounds is not cardiac shock. The heart both of animals and man will withstand extraordinary ill-usage. The fatality is due to the mechanical obstruction of the diastole by effusion of blood into the pericardial sac. A heart which has almost or quite stopped beating has been restored by aspiration of the blood in the sac, and this should be borne in mind in dealing with patients apparently dead.

Turning to the records of operation, there are in the literature up to 1912 about 239 cases treated by suture, whereof 140 died and 99 recovered, a death-rate of 58·5 per cent. Probably the true death-rate is a little higher, some failures being likely to pass unreported. A later series, reported by Constantini in 1920, gives 287 cases and 141 recoveries after operation. Knife wounds were slightly more dangerous than wounds due to projectiles.

Success depends upon several factors.

- 1. It is essential, of course, that operation should be very prompt.
- 2. The mode of obtaining access is important. A flap with the hinge external is less likely to cause fatal double pneumothorax than one with the hinge internal. The stab wound has usually opened one pleura already.

In two series, the results were as follows :—

MORTALITY IN WOUNDS OF HEART.

Region	Cases	Died	Mortality
			per cent
<i>Peck's series—</i>			
Auricles - - -	11	4	36
Left ventricle - -	74	45	61
Right ventricle - -	69	48	70
<i>Constantini's series—</i>			
Auricles - - -	36	14	38
Left ventricle - -	119	66	55
Right ventricle - -	102	52	52

Death usually occurs on the table, or shortly afterwards; but some cases have developed aneurysm (nine on record) or leakage of the suture line; and suppuration has been responsible for some deaths, especially if the pericardial sac was drained.

A considerable number of patients with shrapnel or other metallic fragments embedded in the heart wall, or even loose in the cavity, survived long enough to be operated on during the Great War. R. Le Fort met with so many as 9 cases, in 2 of which the foreign body was inside the ventricle. He removed the metal in all cases, and 8 made a good recovery. In one of these he had to disengage the fragment from the chordæ tendineæ. Duval collected records of 39 cases of projectiles embedded in the

heart wall; 23 recovered without operation, and 13 out of 16 got well after removal. There were also 23 patients with the missile within the heart; 12 out of 13 not operated on did well, also 7 out of 10 which came to operation. The heart seemed to tolerate small fragments; larger ones crippled its function by inducing pericardiac adhesions.

REFERENCES.—Peck, *Ann. of Surg.* 1909, 1, 101; Pool, *Ibid.* 1912, iv, 485; Le Fort, *Lancet*, 1918, ii, 334; Duval, *Bull. et Mém. Soc. de Chir. de Paris*, 1918, Dec.; Constantini, *Jour. de Chir.* 1920, xvi, 383.

A. Rendle Short.

HEMIPLEGIA.—(See STROKES.)

HERNIA.—In young children, up to the age of four years, it is undoubtedly possible to cure some cases, probably only a minority, by the use of a truss. If this is to be efficient, the hernia must never be allowed to come down, or all the benefit previously obtained is lost. What usually happens, no doubt, is that the sac becomes very narrow, and it may well be that heavy straining in adult life would re-open it. On this point we lack evidence. But it is quite certain that occasionally the neck of the sac may be obliterated. This has been verified by subsequent operation in one or two cases. In older children or adults, cure of hernia by means other than an operation is so rare as to be practically negligible.

Femoral hernia in infants is seldom cured by a truss.

The great majority of cases of umbilical hernia in infants disappear after a year or so, if a pad and bandage is worn. We do not know if they ever come back again in middle life.

The Danger of Strangulation.—It is very difficult to estimate the frequency with which a hernia becomes strangulated. Macready puts it at 1.6 per cent. The proportion of cases of strangulated to those of reducible inguinal hernia seen at a hospital is perhaps about 1 in 20; it is mere conjecture what proportion of the herniated members of the community who depend upon hospitals for surgery present themselves at those institutions for examination, but probably nowadays it is from a quarter to a half, which agrees pretty well with Macready's opinion. Femoral and umbilical hernias become, in proportion, much more frequently strangulated. All femoral hernias, therefore, ought to be operated on.

The risks of strangulation in persons who neglect treatment year after year, and neither have an operation nor wear a truss, must be much higher than 1.6 per cent, because this diminishing class furnishes the majority of the strangulation cases. It is a mere guess, but such a patient's prospects of calamity are probably 30 to 50 per cent in the long run, especially in the femoral and umbilical varieties.

The Results of Operation.—We shall have to consider: (1) *The operation mortality*; (2) *The prospects of cure or relapse.*

1. **THE OPERATION MORTALITY.**—This is, of course, very low nowadays. A few years back it was by no means inconsiderable; in four London hospitals in 1890 it was as high as 6 per cent. To-day, however, it is only from 0.25 to 0.5 per cent in adults, and a little higher in infants (Bull and Coley). Brenner, of Vienna (1906), quotes 2000 cases with 5 deaths (0.25 per cent). Pott's enormous figures, running into thousands, for the years 1895 to 1903, show: inguinal hernia, 0.7 per cent died; femoral hernia, 0.5 per cent died; ventral hernia, 1.1 per cent died. At the Massachusetts General Hospital, 1500 cases were operated on by 75 surgeons. There were 8 deaths (0.5 per cent). The vas was cut 7 times, and the bladder injured twice. In 158 cases, healing by first intention failed to occur. Amongst 2486 operations, between 1899 and 1918, at the Johns Hopkins Hospital, the death-rate was 0.48 per cent (4 died of pulmonary embolism, 4 of pneumonia, 1 of myocarditis, 1 of status lymphaticus, and 2 of meningitis).

Fatalities are due to sepsis, pneumonia, anæsthetic calamities, and totally extraneous occurrences. Thus, the writer lost a patient who developed typhoid fever; four or five instances are known in which the femoral vessels have been injured, and some of these have been fatal; deaths have resulted from wounding the bladder in the sac, its presence not having been recognized by the operator. The writer has also heard of unreported cases in which fatal intestinal obstruction followed, due in one instance to imprisonment of a loop of bowel by the inverted sac in Kocher's operation, and in another to the intestines becoming entangled in adhesions about a filigree.

2. THE PROSPECTS OF CURE AFTER OPERATION.—

a. Inguinal Hernia.—The introduction of the Bassini method has greatly improved the results in adults. The older methods gave as high a proportion of relapses as 30 to 40 per cent (Bull and Coley). Simple ligature of the sac, without slitting up the external oblique, in adults, was followed by recurrence in nearly 30 per cent of the cases (Pott). In children, however, it is almost always successful; Kellock had no failures in 52 cases.

CURES AFTER VARIOUS OPERATIONS FOR HERNIA.

REPORTER	INGUINAL						FEMORAL					
	Bassini		Kocher		Simple ligature of sac		Ring not closed		Ring closed		Closure above Poupart's lig.	
	Cases	Cured	Cases	Cured	Cases	Cured	Cases	Cured	Cases	Cured	Cases	Cured
Pott - - - - -	1851	90·1	376	92·5	1419	71·6	158	63·3	155	71·6		
Bull and Coley - - -	837	99·0	—	—								
Kellock (children) - -	—	—	—	—	52	100 0						
Simmonds - - - - -	113	93·0										
Dreesman - - - - -	403	97·5										
Fagge; Morton - - -	—	—	—	—	—	—	—	—	—	—	25	88
Bristol Royal Infirmary -	—	—	—	—	—	—	41 cases, 73 per cent cured				37	100
Fischer - - - - -	—	—	—	—	—	—	—	—	—	—	37	100
Cole - - - - -	—	—	—	—	—	—	—	—	—	—	37	100
Johns Hopkins Hospital, 1899-1918 - - - -	Indirect hernia : 816 cases, 46 recurrences. Direct hernia : 77 cases, 17 recurrences.											

The Bassini operation gives much better results. Pott's huge collection of German figures, published in 1903, shows about 10 per cent of recurrences, but other results are much more favourable. Simmons gives the statistics for 1905 for Massachusetts Hospital, the cases being examined in 1909; in 113 cases followed, there were 7 per cent of relapses. Of the 1500 cases at a later period at the same hospital recorded by Davis, 3·7 per cent recurred (3 per cent after Bassini's operation, 4·4 after Ferguson's). Dreesman, 1913, quotes only 2·5 per cent out of 403 operations. The careful and reliable follow-up system at the New York Hospital shows 20 relapses amongst 539 patients inspected at intervals after operation (= 3·7 per cent). Coley quotes less than 1 per cent, but a large number of his patients were children (20 recurrences in 2480 male inguinal hernias = 0·8 per cent). The true figure, nowadays, is probably less than 1 in 20. This agrees with the recurrence-rate, 5 per cent, amongst 816 cases of indirect hernia operated on at the Johns Hopkins Hospital. The results in direct hernia are not so good. If relapse is going to occur, it will usually be in the first year.

Kocher's operation gives equally good results, according to Pott's figures.

Apart from recurrence, there are certain more or less trivial sequelæ of the hernia operation not infrequently found if looked for. A small hydrocele may develop in 18 per cent, and in some of these it persists. The tunica vaginalis may be thickened in 11 per cent. The patient is usually unconscious of these abnormalities (Erdman). In this carefully followed-up series of 148 cases, there were 9 recurrences (= 6 per cent), but only 2 out of 102 were straightforward cases of indirect hernia treated by Bassini's method.

b. Femoral Hernia.—According to Coley, there were no relapses in 141 cases of operation for femoral hernia, but this merely means that no patients returned to him; he did not examine, or hear from, those alleged to be cured. Pott's figures are by no means flattering to surgery; of 158 cases operated on before 1903, without closure of the ring, more than a third recurred; and when the ring was sutured, nearly 30 per cent relapsed. At the Bristol Royal Infirmary, of 41 cases treated by various methods, 30 were well from eighteen months to four years afterwards, and 11 had relapsed, that is, 27 per cent.

Making use of the new method of closing the ring above Poupart's ligament, C. A. Morton found 7 cases free from recurrence, and Fagge had 3 failures after 18 operations. Fischer and Cole each report 37 cases of this operation (Lothiesen's), with no recurrences.

c. Umbilical or Incisional Hernia.—The results in these cases appear to be less satisfactory than in either of the others, and failures are often seen in English hospital practice after operations by the older methods. Of 86 cases followed through by Pott, 54·7 per cent were cured, but nearly half relapsed. At the Bristol Royal Infirmary, of 9 cases of umbilical hernia followed eighteen months to four years, 5 were cured and 4 relapsed. Warren has followed up 24 cases operated on by the Mayo technique; only 3 relapsed, and these only showed a slight bulge (7 umbilical, 17 incisional).

REFERENCES.—Pott, *Deut. Zeits. f. Chir.* 1903, lxx; Coley, *Keen's Surgery*, 1913 edition, 588; Kellock, *Proc. Roy. Soc. Med. (Surg. Sect.)*, 1912, pt. iii, 26; Simmonds, *Boston Med. and Surg. Jour.* 1910, clxii, 847; Capelle, *Beitr. z. klin. Chir.* 1909, lxxiii, 264; Fagge, *Proc. Roy. Soc. Med.* 1911 (*Surg. Sect.*), 165; Erdman, *Ann. of Surg.* 1917, Dec., 702; Davis, *Jour. Amer. Med. Assoc.* 1916, lxxvii, 480; Fischer, *Ann. of Surg.* 1919, April, 482; Cole, *Brit. Med. Jour.* 1919, i, 768; Gibson, *Jour. Amer. Surg. Assoc.* 1919, 429; Taylor, *Arch. of Surg.* 1920, i, 382; Warren, *Lancet*, 1920, exciv, 1048.

A. Rendle Short.

HERNIA, STRANGULATED.—If we use the term in its strict sense, excluding cases in which the herniated loop of bowel is merely obstructed by faeces, strangulated hernia, apart from treatment, is practically a death warrant. It would be quite impossible to-day to obtain figures showing in how many patients the hernia would discharge its contents through the skin, and so save life at the expense of a faecal fistula. In the great majority of cases in which this happens, death nevertheless supervenes, and until this release occurs the patient's condition is most pitiable, on account of burrowing abscesses and very violent and extensive dermatitis set up by the irritation of the contents of the small intestine.

The percentage of spontaneous cures in cases of strangulated hernia is said to be about 2 per cent (Coley, in *Keen's Surgery*).

Gangrene of the Gut.—The occurrence of this complication depends upon three factors: the tightness of the constriction, the length of time that the hernia has been strangulated, and the situation. Of these, the first is the most important. In a series observed during five years at St. Thomas's Hospital, Corner found gangrene in 4 per cent of the inguinal, 10 per cent of the femoral, and 25 per cent of the umbilical cases of strangulated hernia. Usually it takes about three days to develop; there are, however, very many recorded instances in which gangrene has supervened in a day. Out of 119 cases of strangulated hernia at the Bristol Royal Infirmary, 2 had become gangrenous in less than twenty-four hours, and 1 in less than twelve hours; there is a case in the literature which gangrened in four hours. Of course, gangrene makes the prognosis as to life much graver.

Duration of Life and Cause of Death.—Apart from operation, the average duration of life, according to old figures supplied by Macready, is about seven to ten days. It may be much shorter; there are many recorded instances of a fatal issue within twenty-four hours, and two have been known to die within a couple of hours.

The cause of death is usually peritonitis; next to this, profound toxæmia. Others die of various lung complications, either from inhalation of foul vomit, or from embolic pyæmia.

Treatment by Taxis.—In the days of pre-antiseptic surgery, prolonged and vigorous taxis was employed in almost all cases. Of course it frequently failed, and recovery by no means always took place even when it succeeded in reducing the hernia. Thus, according to Frickhöffer (1861), of 300 cases of strangulated femoral hernia reduced by taxis, 14·9 per cent died, and of 518 cases of strangulated inguinal hernia, 7·8 per cent died. The deaths were due to reduction of gangrenous gut, rupture of the gut, *réduction en masse* (or reduction into another sac), pre-existing peritonitis, or paralysis of the bowel.

Nowadays, taxis is only employed with gentleness, and as a means of diagnosis, in early cases; in late cases, it is usually possible to tell almost immediately, by the feel, that taxis would be hopeless.

In young children, the writer has had considerable success in getting back a hernia strangulated less than twelve hours by tying the child in bed in an inverted position and giving chloral. This is often valuable, as it allows an immediate operation to be converted into a deliberate one.

Used only in early cases, for a short time, and with a light hand, taxis is not likely to cause any damage, and if the bowel can be returned the patient will almost certainly get well. I have seen profuse bloody diarrhoea follow. Of 24 cases reduced by taxis at the Bristol Royal Infirmary since 1900, every one recovered. If the patient is reasonably fit, it is better to operate so as to cure the hernia.

Treatment by Operation.—One of the oldest of surgical operations, herniotomy for strangulated hernia has improved immensely in its results of late years.

Between 1836 and 1841, of 183 herniotomies in Paris, 62·2 per cent died. Between 1869 and 1888, of 283 herniotomies for strangulated inguinal hernia in four London hospitals, 59 per cent died.

The results of more modern surgery, running up to the date of compilation of the first edition of this book in 1914, may be gathered from the following table :—

RESULTS OF OPERATION FOR STRANGULATED HERNIA, UP TO 1912.

HOSPITAL	INGUINAL			FEMORAL			UMBILICAL			OBTURATOR		
	Cases	Died	Per cent	Cases	Died	Per cent	Cases	Died	Per cent	Cases	Died	Per cent
St. Thomas's, ¹ 1907 to 1911 -	111	21	—	103	24	—	30	14	—	2	0	—
Middlesex, ² 1907 to 1911 -	37	8	—	29	3	—	11	2	—	3	3	—
Bristol Royal Infirmary, 1900 to 1912 -	119	22	—	96	14	—	11	2	—	0	—	—
Total -	267	51	19	228	41	18	52	18	34·5	5	3	60

It will be observed that the mortality for inguinal and femoral hernia was approximately the same, a little under 20 per cent ; that umbilical hernia was decidedly worse, and that in the majority of obturator hernias the patients died.

This agrees well with the experience of seven German writers quoted by Meyer ;³ out of 1429 cases of various herniæ strangulated, 20·7 per cent died ; in 56 cases of obturator hernia, Meyer reports 32 deaths, that is, 57 per cent.

At the present time, the mortality of strangulated inguinal and femoral hernia is less than 20 per cent, because patients are sent up sooner. This is shown in the accompanying table. The New York figures are taken from Gibson's report of the follow-up system at the New York Hospital. My own represent all the cases, hospital and private, that I have operated from 1914 to 1920 inclusive (with the exception of the period spent in France during the war). It will be observed that the data for umbilical hernia have not improved with the others ; cases are still sent in too late.

RESULTS OF OPERATION FOR STRANGULATED HERNIA, 1914-1920.

HOSPITAL OR SURGEON	INGUINAL			FEMORAL			UMBILICAL		
	Cases	Died	Per cent	Cases	Died	Per cent	Cases	Died	Per cent
New York Hospital, 1914 to 1918	41	6	14·6	11	1	9	9	5	55
Rendle Short, 1914 to 1920 -	30	2	6·6	45	5	11	13	7	57

We have next to consider the results of operation under certain special conditions.

The Age of the Patient.—All writers agree that the prognosis is much more grave in elderly persons. Children usually do well. According to Collins,⁴ the mortality in 1902

was 23 per cent, but it is now 3 to 10 per cent, given early interference. Of 12 cases in infants under two years of age treated by operation at the Bristol Royal Infirmary, every one recovered.

The Time of Operation.—It is no doubt true, in the main, that good results depend on early operation. Macready⁵ calculates from 129 cases :—

Operation within 24 hours	-	-	12·5 per cent died
„ 24-48 „	-	-	26·1 „ „ „
„ 48-72 „	-	-	36·3 „ „ „
„ after 72 „	-	-	44 „ „ „

It is a remarkable fact, however, in the (older) figures of the Bristol Royal Infirmary, that the correspondence is by no means so close as might have been expected. After three or more days of strangulation, 55 cases (25 inguinal, 30 femoral) were operated on ; of these, 9 died, that is, 16 per cent, positively less than in those operated on early ! It would be most calamitous, of course, to use this as an argument for delay. The truth is that cases with marked symptoms are likely to obtain help and get treated early, whereas there is a type of strangulation which comes on more quietly and is not so rapidly fatal.

The best results were obtained by operation within twenty-four hours. Of 88 such cases at the Bristol Royal Infirmary (femoral and inguinal), only 7 died, that is, 8 per cent, instead of the general average of nearly 20 per cent. Of these 7 cases, some showed gangrenous gut and some were very aged.

The Various Methods of dealing with Gangrenous Gut.—When gangrenous gut is found at operation, two courses are open. We may either resect the loop, including any dilated paralyzed coils on its proximal side, or we may content ourselves with making an artificial anus. From a study of the literature and hospital records, Hesse⁶ gives the results as follows :—

Operation	Cases	Died	Per cent
Artificial anus	604	431	71·3
Resection of loop	860	382	44·3

It must not be concluded from these figures, however, that resection is invariably the best treatment. No doubt the higher mortality is partly due to the fact that the very worst cases were treated by making an artificial anus. Like all literature figures, the results are probably shown in an unduly favourable light, owing to the publication of successes and suppression of failures.

Of 30 cases seen at St. Thomas's Hospital⁷ :—

18	were treated by resection ;	8 cured, 10 died.
10	„ enterostomy ;	1 cured, 9 died.
2	„ invagination ;	2 cured, 0 died.

Prognosis in Individual Cases.—*Before operation*, the principal guides to an accurate prognosis are the age of the patient, the degree of collapse, and especially the frequency and nature of the vomit. If the latter consists of foul jejunal contents, the outlook is grave ; if it is definitely faecal in odour, the patient is usually doomed. Evidence of peritonitis makes an almost hopeless prognosis ; so does a sense of rupture with sudden cessation of the pain.

At operation, a Richter's hernia makes for a rather worse prognosis ; and, of course, the presence of gangrene is very ominous. Meyer reports 252 German cases in which gangrene was found ; the death-rate in various statistics was from 50 to 85 per cent.

After operation, persistent vomiting is a grave sign ; it may mean paralysis of the gut. Sometimes washing out the stomach may give great relief if the vomiting is only due to jejunal contents therein. Pituitary extract, physostigmine, salines, or croton oil may overcome the paralysis of the loop of bowel. Death after operation, in my own cases, has nearly always been due to pneumonia. It is probable that gas-oxygen anæsthesia might save some of these fatalities.

As already stated, strangulated umbilical hernia is worse than femoral or inguinal, partly because the patient is likely to be old, fat, or bronchitic, and also because there is

a tendency to consider it as merely obstructed, and so to delay treatment. Strangulated obturator hernia is dangerous because it is often diagnosed late.

REFERENCES.—¹*St. Thomas's Hosp. Rep.* ; ²*Middlesex Hosp. Rep.* ; ³*Meyer, Arch. f. klin. Chir.* 1914, ciii, 497 ; ⁴*Collins, Ann. of Surg.* 1913, lvii, 188 ; ⁵*Macready, Treatise on Ruptures* ; ⁶*Hesse, Beitr. z. klin. Chir.* 1907, iv, 1 ; ⁷*Corner, Lancet*, 1908, i, 1692 ; Gibson, *Trans. Amer. Surg. Assoc.* 1919, 429.

A. Rendle Short.

HEROIN HABIT.—(See DRUG HABITS.)

HIGH TENSION, ARTERIAL.—(See ARTERIAL TENSION, HIGH ; ARTERIOSCLEROSIS.)

HIP, CONGENITAL DISLOCATION OF.—Apart from surgical interference, the outlook in this deformity is not favourable. Natural cure appears to be unknown, although there are a few records of improvement in patients with partial dislocation or subluxation. In ordinary, the lameness, shortening, and difficulty in walking increase rapidly during the years of growth, and even those children in whom the deformity is at first scarcely noticeable are eventually seriously crippled. In bilateral cases a good deal of spasm often develops, and the patient may become a chronic invalid.

We shall have to consider the results of two methods of treatment : (1) *The open operation* ; and (2) *The 'bloodless' reduction by Lorenz's method.*

1. **The Open Operation.**—This is seldom performed now, though favoured by Burghard. There has been a considerable mortality, and it is apt to cripple the muscles a good deal. Tubby has performed it 10 times ; 4 gave a good result, and 6 relapsed. Allison and Dixon also report only 4 satisfactory results out of 10 operations.

2. **The Lorenz Operation.**—This operation is only suitable within narrow age-limits, from three years old up to eight in bilateral, or ten in unilateral, cases. The risks are small. There is almost no mortality, 4 deaths in 1235 cases, according to Deutschlander—that is, about 0·3 per cent. Occasionally the femur may be fractured ; R. Jones has seen this happen 4 times in 38 cases, and in the records of five Continental surgeons it appears 35 times in 856 cases (4 per cent). A transient paralysis sometimes follows the manipulation—23 times in 755 French and German cases (3 per cent)—but it soon clears up.

The results obtained are almost always an improvement on the previous condition, and the case often terminates in a more or less perfect cure, but usually there is some slight deviation from the normal, such as a tendency to abduction. Putting the femur in place undoubtedly makes it grow ; Joachimstal used to reduce one leg at a time in bilateral cases, and found that the bone first replaced became longer than its fellow.

It is difficult to tabulate the success of the operation, because writers classify their results so differently. Lorenz, dealing with 572 cases, claims a cure in 63 per cent ; his unilateral cases gave slightly better results. Ridlon obtained perfect results in 80 per cent of the unilateral cases with backward and upward dislocation, 60 to 70 per cent with a directly backward dislocation, and only 50 per cent when the displacement was forwards. Bilateral cases only gave a perfect result in about half. Galeazzi published a statistical study of 1000 (mostly Italian) cases treated between 1908 and 1912 ; 84 per cent are stated to be cured, but being literature figures these results may be too favourable. Packard, of Colorado, reports 59 cases (33 unilateral, 13 bilateral) with 39 anatomical and functional cures, 16 anterior transplantations, and 4 posterior.

We may conclude that in careful hands, accustomed to the method, about three-quarters of the unilateral cases, and about half of the bilateral, give a thoroughly good, almost ideal, result, and that one in ten is a failure.

REFERENCES.—Tubby, *Deformities, including Diseases of Bones and Joints*, vol. i ; Ridlon, *Surg. Clin.* 1917, 271 ; Galeazzi, *Arch. di Ortopedia*, 1915, Fasc. ii ; Packard, *Colorado Med.* 1918, xv, 135 ; Allison and Dixon, *Interstate Med. Jour.* 1917, xxiv, 161.

A. Rendle Short.

HIP, TUBERCULOUS.—(See ARTHRITIS, TUBERCULOUS.)

HODGKIN'S DISEASE.—(See LYMPHADENOMA.)

HYDATID DISEASE.—Hydatid disease of the liver and other viscera in the upper abdomen will here be considered.

Prognosis apart from Treatment.—The condition may last for many years without giving rise to trouble ; Rolleston mentions a patient who had been tapped for hydatid

twenty years before, and in whom the cyst had recurred. But a hydatid large enough to be diagnosed is always a source of danger to the host, the principal risks being rupture and suppuration.

Rupture may be sudden, or a gradual leakage. Sudden rupture is often fatal. According to Cyr: from rupture into the peritoneal cavity, 90 per cent die; into the pleural cavity, 80 per cent; bile-ducts, 70 per cent; bronchi, 57 per cent; stomach, 40 per cent; intestines, 15 per cent; on the surface, 3 per cent. Occasionally the cyst may burst into the pericardium or inferior vena cava; these are usually fatal accidents. If leakage takes place into the peritoneal cavity, an immense number of hydatids may keep on growing in the abdomen and pelvis. The writer has seen a patient whose abdomen had to be opened again and again for obstruction and pelvic pressure.

Suppuration produces a large abscess of the liver which, apart from treatment, is likely to be fatal.

Results of Treatment.—The principal methods of treatment are by aspiration and by enucleation of the cyst.

Aspiration has the advantage of simplicity, but not of safety. Leakage through the puncture may follow and give rise to peritonitis or to dissemination, and there are cases on record where fatal hæmorrhage has resulted. Although this treatment is often successful, the parasite is not always killed, and may grow again.

Enucleation is both more certain and less risky. It is well to inject the cavity of the hydatid with a little corrosive sublimate solution to kill the scolices and prevent dissemination if any fluid is spilled.

Both after aspiration and after enucleation, but especially the former, curious symptoms, called by the French 'intoxication hydatique', may be met with. In the milder cases there is no more than an attack of urticaria. In severe cases, which are however very rare, there may be collapse, convulsions, dyspnœa, and death within a few hours, without urticaria. Inasmuch as this result has been met with even when it is certain that very little of the fluid could have been spilled, it is probably a variety of anaphylaxis.

REFERENCES.—Rolleston, *Diseases of the Liver, Gall-bladder, and Bile-ducts*, 1912, 410; Dévé, *Rev. de Chir.* 1911, 513.

A. Rendle Short.

HYDROA.—(See PEMPHIGUS AND PEMPHIGOID AFFECTIONS.)

HYDRONEPHROSIS.—Prognosis in regard to life in hydronephrosis depends on the following factors: (1) *The nature of the obstruction*; (2) *The condition of the second kidney*; (3) *The presence of complications*; (4) *The success of operative measures*.

1. **The Nature of the Obstruction.**—Hydronephrosis may be due to malignant disease of the bladder or other pelvic organ. In such cases the dilatation of the kidney is moderate in degree, and there is rarely the development of a large abdominal swelling. The obstruction is, however, bilateral, and on that account, as will be seen later, the prognosis is grave. The chief factor governing the prognosis is, however, the malignancy of the growth causing the obstruction. The growth in such cases is extensive, and from the point of view of radical cure is inoperable. The condition develops most frequently in malignant disease of the bladder, causing obstruction to the ureteral orifices. It is seldom that this stage is reached without sepsis being superadded, and pyonephrosis results. In malignant growths of the pelvic organs, obstruction of the ureters takes place less frequently. It is surprising how the ureter may be surrounded by malignant growth and still remain pervious.

Congenital hydronephrosis is usually due to obstruction in the urethra, although occasionally no obstruction can be discovered. The resulting dilatation of the kidney is bilateral, and the prognosis is very grave, death taking place soon after birth in most cases. Occasionally congenital hydronephrosis is unilateral, but in these cases other congenital lesions are usually present, such as cleft palate, congenital atony of the colon, or other conditions, which contribute to a fatal result in early life.

In the majority of cases of hydronephrosis the cause of the obstruction is a valve, kink, band, or other similar condition, and there is nothing in the nature of this obstruction itself that will affect the prognosis.

2. The Condition of the Second Kidney.—This factor, which governs the prognosis in all diseases causing destruction of the kidney tissue, is especially important in hydronephrosis.

a. Bilateral Hydronephrosis.—Of the various diseases which may affect the second kidney when one kidney is hydronephrotic, hydronephrosis is the most common; about two-thirds of the cases are bilateral. In 665 collected cases, Newman found 217 unilateral and 448 bilateral.

Bilateral hydronephrosis is a progressive and fatal disease. When the obstruction remains unrelieved, death takes place after a period which varies greatly, but which always extends to several years. The cause of death is destruction of kidney tissue and resulting uræmia. The picture presented by the patient is one of gradual failure of the renal function. There is progressive emaciation, listlessness, headache, thirst, loss of appetite, and, in the later stages, vomiting with complete anorexia, and recurring attacks of uræmia. The temperature, apart from intercurrent infection, is subnormal throughout. In some cases of bilateral hydronephrosis, few symptoms are observed until the very latest stages. A patient may have two hydronephrotic kidneys which form large abnormal tumours easily recognized by the eye, and appearing at different times or simultaneously, and yet present no symptom of renal failure, and enjoy good, if not robust, health. There is, however, the certainty that the balance of renal secretion may easily be upset by a chill or other cause, and death takes place rapidly from uræmia; or that, if the recurring obstruction remains unrelieved, slow progressive renal failure will eventually supervene. The prognosis in bilateral hydronephrosis depends also upon the cause. Congenital hydronephrosis, and hydronephrosis due to malignant growths in the pelvic organs, are, as already stated, beyond surgical aid, and are invariably fatal. Where the obstruction is remediable, as in ureteral obstruction, stone, obstructing bands, vessels, valves, kinks, etc., the prognosis depends upon how far the destruction of renal tissues has been allowed to progress before operation; in other words, upon the ability of the medical attendant to make an early diagnosis. The results of operation will be referred to later.

b. Other Diseases of the Second Kidney.—In 8 collected cases of anuria following operation upon a hydronephrotic kidney, the second kidney was hydronephrotic in 2, atrophic in 2, the seat of nephritis in 2, and there was no second kidney in 2 cases. The prognosis in all these cases, apart from any operation, is very grave, and the fatal issue cannot be long delayed.

3. The Occurrence of Complications.—

a. Infection.—The most common complication is infection of the hydronephrosis, and this has an important bearing on the form of operation, and on the ultimate result of the disease. A hydronephrosis is dangerous to life merely from the destruction of kidney tissue. If infection is added, this destruction takes place more rapidly and completely, and further, the danger of absorption from a large pus-containing cavity is superadded.

A very considerable proportion of cases of hydronephrosis eventually become infected. The entrance of bacteria may take place by way of the urethra and bladder after catheterization, but much more frequently the infection is hæmatogenous in origin. Whether infection takes place directly through the wall of the hydronephrosis from the overlying and occasionally densely adherent bowel, is not certainly known. It appears likely that infection may take this route. It may be of a mild character, so that the contents of the dilated kidney are cloudy, and the deposit small in amount; such an infection does not endanger life from absorption, or militate against the success of plastic operations on the kidney. On the other hand, the infection may take a more active form, and the dilated kidney contain a large quantity of pus, while there are a high swinging temperature and other signs of toxæmia. The prognosis in such a case is much more grave, death taking place in unrelieved cases from toxic absorption, or from this combined with uræmia. It is rarely possible to operate in such cases with the object of preserving the remaining kidney substance, and the choice lies between a palliative nephrotomy and nephrectomy.

b. Rupture of Hydronephrosis.—This is by no means common, and is almost invariably the result of injury, although this may occasionally be of a trifling character. In

children, rupture into the peritoneal cavity may take place, causing fatal peritonitis; in the adult the rupture is extraperitoneal, and may cause death from suppression of urine. Recovery may, however, follow prompt operation.

c. Uræmia.—This is the last stage of hydronephrosis when the second kidney is absent, or so far diseased as to be incapable of performing the renal function.

4. The Success of Operative Measures.—The success or failure of operation for the removal of obstruction in the urethra, bladder, or renal pelvis depends upon the nature of the obstruction.

Nephrotomy has been performed in congenital bilateral hydronephrosis, without averting a fatal result. It may be used as a preliminary to plastic operation on the kidney.

Nephropexy, nephrolithotomy, the removal of bands and of aberrant renal vessels, and plastic operations on the renal pelvis, its outlet, and the ureter, may be required.

The degree of success attending any of these operations depends upon the early diagnosis of hydronephrosis. It is now possible by means of pyelography to make a diagnosis before the kidney has reached such a size that enlargement can be detected on palpation of the abdomen. If this is done and the obstruction remedied, the kidney can be saved with little damage to its secreting substance.

In the later stage of hydronephrosis, when a palpable tumour can be detected in the abdomen, the kidney tissue is expanded and much destroyed. The removal of the obstruction does not restore the kidney to its normal state, and only saves what remains of the secreting substance. In the fully developed hydronephrosis, when the layer of kidney tissue is reduced to half an inch or less in thickness, the organ still retains a considerable degree of functional power. I have operated on both kidneys in a case of bilateral hydronephrosis, when each organ was reduced to a thin shell, and the patient is well and without renal symptoms four and a half years after the operation. There are cases of bilateral advanced hydronephrosis in which the patient has lived for many years, and there are other cases where a solitary kidney has been converted into a hydro-nephrotic sac, and yet carried on a renal function sufficient to maintain life.

Schloffer collected 86 plastic operations with the following results :—

Operation	Cases	Deaths	Failures
Section of valves - - -	12	1	3
Uretero-pyeloplasty - - -	18	1	4
Uretero-pyeloneostomy - - -	19	2	6
Lateral anastomosis (ureter) -	13	2	3
Plastic operation in renal pelvis -	1	—	1
Pyeloplication - - -	4	—	—
Orthopædic resection - - -	8	1	—
Combined operations - - -	11	—	—
	68	7	17

Nephrostomy, or incision and drainage of the sac, without any attempt to overcome the cause of the obstruction, is sometimes performed. It is said to have resulted, in from 30 to 45 per cent of cases, in re-establishment of the flow of urine through the ureter and healing of the nephrostomy wound; in the remaining cases a fistula persisted.

Primary nephrectomy is only indicated when the sac is very large and its wall so thin and fibrous that no renal tissue is present, and should only be undertaken when it can be proved that a second kidney is present and efficient. Kümmel performed nephrectomy on 35 cases of unilateral hydronephrosis, with 1 death, and the late results of the operation were uniformly good.

J. W. Thomson Walker.

IDIOCY.—(See MENTAL DISEASES.)

INFANTILE CONVULSIONS.—Convulsive attacks, with symptoms more or less resembling those of epilepsy, may occur in infants of various ages. Here, as in all other diseases, the prognosis depends upon the accuracy of diagnosis of the underlying cause.

In newly-born children, convulsions may occur immediately after birth, or within a few days. They are specially common after a prolonged and difficult labour, and first-born children are, therefore, more liable to such convulsions than later-born children. In these birth-convulsions, the convulsive movements, if limited to one side, are strongly suggestive of a cortical hæmorrhage, generally from rupture of meningeal veins. If such hæmorrhage be so severe as to produce structural changes in the cerebral cortex, the unilateral convulsions are likely to be followed by permanent hemiplegia, more or less profound. Bilateral cortical hæmorrhages, from the same causation, produce bilateral symptoms of the same kind, and are amongst the commonest causes of bilateral hemiplegia (diplegia). As birth-hæmorrhages are generally situated on the vertex, the cortical centres which are situated nearest to the middle line—i.e., the centres for the lower limbs—are most severely affected; hence the resulting hemiplegia or diplegia is usually most intense in the legs.

Other newly-born children suffer from convulsions which are apparently the result of excessive venosity, or other morbid condition, of the blood, without actual cortical hæmorrhage. Such children are cyanosed, and may be severely convulsed, but the convulsions do not show the same constant commencement on the same side; they vary in their mode of onset, starting sometimes on one side, sometimes on another. In such cases, the prognosis as to the absence of subsequent paralysis is better than in persistently unilateral convulsions.

Many cases of generalized convulsions occur later in infancy, independent of any evidence of difficult labour. Such cases are most commonly toxic in origin, e.g., during attacks of diarrhœa from dietetic faults. In these cases, if the gastro-intestinal irritation be treated by suitable food and intestinal antiseptics, the convulsions rapidly subside; nor do they tend to recur or to have any paralytic sequelæ.

Still later in infancy, at the age of eight or nine months, we meet with so-called 'teething convulsions'. Doubtless the irritation of the first dentition is an exciting factor, but the predisposing and underlying cause is usually rickets. Convulsions in rickety children are generally bilateral. In severe cases, they may resemble an epileptic fit; in other cases, the symptoms are much less severe, consisting in sudden pallor of the face and lips, with fixation of the eyes, and sometimes transitory squint, the limbs and trunk meanwhile becoming rigid; in other cases again, clonic movements appear, especially in the face, hands, and feet. Whatever be the particular variety of symptoms present, they are always bilateral. Unilateral spasms generally indicate focal disease, and have a quite different prognosis.

The onset of any acute fever in an infant may be accompanied by convulsions; these are generalized and bilateral, and do not tend to recur after the temperature has become normal. Even in the absence of fever, conditions of temporary cyanosis—e.g., during a paroxysm of whooping-cough—may cause a generalized convulsive attack.

Convulsions of unilateral distribution, often associated with high temperature and delirium, indicate a localized cortical lesion of some sort, most commonly due to the virus of acute polio-encephalitis. If the morbid process destroys a portion of the motor cortex, it is followed by a corresponding permanent hemiplegia or monoplegia of the face, arm, or leg, as the case may be, such weakness varying in intensity from a slight paresis to a profound hemiplegia. Moreover, in this variety of infantile hemiplegia, there is a subsequent tendency to recurrent convulsions on the hemiplegic side of the body.

In the convulsions of meningitis—tuberculous, meningococcal, etc.—the prognosis is that of the underlying disease. In cases of this sort, examination of the cerebrospinal fluid will give us valuable diagnostic and prognostic indications. (*See MENINGITIS.*)

J. Purves Stewart.

INFANTILE DIARRHŒA.—(*See DIARRHŒA, INFANTILE.*)

INFANTILE PARALYSIS.—Poliomyelitis anterior was formerly regarded as a disease *per se*, but recent observations have established the fact that it is but one variety of a wider-spread malady of infective origin, which attacks the central nervous system and its meninges, having a selective action upon the motor nerve-cells. When the brain cortex is affected, we call the disease polio-encephalitis superior; when the motor nuclei

in the bulb are attacked, we call it polio-encephalitis inferior; and when the anterior cornua of the spinal cord are affected, we term it poliomyelitis anterior.

Polio-encephalo-myelitis, therefore, is a febrile disease. It has an incubation period of six to eight days, and a febrile phase lasting about three or four. The muscular paralysis appears during the stage of pyrexia. If the cortical motor cells are affected (**polio-encephalitis superior**), there are usually convulsions at the start; these subside, and may leave the child monoplegic, hemiplegic, or diplegic, according to the extent of permanent cortical destruction. If the cells of the spinal cord are mainly attacked (**poliomyelitis anterior**), there is a widespread flaccid paralysis of the trunk and limbs, varying in distribution in different cases, and corresponding to the extent of grey matter that is affected. The initial paralysis reaches its maximum in a few hours, and is always more widespread than the permanent residuum of muscular atrophy; for many of the nerve-cells during the acute stage of the disease are merely affected by inflammatory and œdematous changes, and if there is nothing beyond an inflammatory œdema, there is a possibility that the cells may still recover. If, however, some of the nerve-cells are actually destroyed by the inflammatory process, as is generally the case, the corresponding muscle-fibres undergo permanent atrophy and paralysis.

It will be seen, from what we have said, that the prognosis of this disease differs according to the stage at which it comes under observation.

During the acute febrile stage, if there is no implication of the vital medullary centres, and the patient survives, the probabilities are that the paralysis will, in time, clear up to a certain extent. It is even possible that if the cells have been merely œdematous, and not actually destroyed, they may all recover, and the initial flaccid paralysis or paresis of the limbs or trunk clear up completely. This, however, is uncommon, and it is more usual to find that, whilst some muscles recover, other muscle-groups remain feeble and undergo wasting, indicating that destructive changes have occurred in the anterior cornual cells.

When the acute febrile stage has passed off, the question of the amount of permanent recovery arises. This question is best answered by a consideration of the electrical reactions of the affected muscles, especially the faradic reactions. We wait until ten days, at least, have elapsed from the onset of the paralysis, in order to allow time for any degenerative changes in the nerve-cells and muscle-fibres to be recognizable. After ten days or a fortnight, when some of the muscles have recovered voluntary power, whilst others are still flaccid and paralyzed, we proceed to examine these paralyzed muscles electrically. Those which still react to faradism will ultimately recover, those in which faradic excitability is lost will probably remain permanently paralyzed. Other muscles, again, show mere diminution in faradic response; these will recover to some extent. The recovery of those muscles which are recoverable will be hastened by assiduous skilled massage and passive movements.

If the patient is already in the chronic stage by the time he comes under observation, we have now to deal with the relics of an antecedent disease. Presuming that all the surviving muscles have been brought to their maximum development by a preliminary course of suitable massage and electrical treatment lasting six months or longer, we have to consider the prospects of preventing or diminishing deformities, and of enabling the patient to make some use of his paralyzed limb. This is largely a matter for the ingenuity of the orthopædic expert. When the limb is flaccid and flail-like, the question of fixation of certain joints arises. This can sometimes be accomplished by arthrodesis; at other times by the application of a light splint, preferably made of celluloid. In other cases again, where the muscles on one aspect of a joint are paralyzed, whilst their antagonists are still active, transplantation of the insertions of muscles or tendons from the healthy to the paralyzed aspect of the joint, together with division or lengthening of shortened tendons, may serve to restore a certain measure of useful mobility to a joint, and to correct deformities. Surgical measures, however, should not be thought of until the limb has had a previous thorough course of massage and passive movements for several months at least, together with a suitable posture to ensure that the paralyzed muscles are prevented from being constantly stretched. It is astonishing how often a limb, which at first seemed hopelessly paralyzed, recovers part of its motor power, without the necessity for surgical interference. (*See also TALIPES.*)

J. Purves Stewart.

INFANTILE PYLORIC STENOSIS.—(*See* PYLORUS, CONGENITAL STENOSIS OF ; STOMACH, SURGICAL AFFECTIONS OF.)

INFANTS, SPLENIC ANÆMIA OF.—(*See* ANÆMIA, SPLENIC, OF INFANCY.)

INFERIOR VENA CAVA, WOUNDS OF.—The inferior vena cava is occasionally ruptured by contusion of the abdomen, and this is a cause of very rapid death. The writer has seen one such case. The effusion of blood was very small, but apparently the heart failed because it received an inadequate quantity.

The inferior vena cava has several times been torn in removing a right kidney. Albarran considers that the best treatment is to ligature it ; he collects from the literature records of 5 cures and 2 deaths following this procedure. *A. Rendle Short.*

INFLUENZA.—The prognosis in influenza depends primarily on the virulence of the organism, which varies greatly in different epidemics. Uncomplicated influenza is rarely dangerous to life. The mortality in the epidemic of 1889–90 was in Munich 0·6 per cent, in Mecklenburg-Schwerin 1·2 per cent, in Leipzig 0·5 per cent, in the German army 0·1 per cent, in fifteen Swiss towns 0·1 per cent. These figures do not include cases of death from influenzal pneumonia. The mortality from this varies from 15 to 26 per cent.

The increase in the general mortality-rate during an epidemic of influenza is chiefly due to increased mortality from acute diseases of the respiratory organs, and to a rise in the death-rate of pulmonary tuberculosis. In the whole of Germany during the epidemic of 1889–90, about 66,000 succumbed. Owing to the more malignant character of subsequent epidemics, both in England and Germany, the death-rates were higher. Thus, deaths from influenza in London from January to March, 1890, were 558 ; from May to July, 1891, 2104 ; from January to March, 1892, 2078. In 1918 the deaths in London during one week reached 2458. The mortality of the recent epidemic was more than six times as large as that of the epidemic of 1900, but the mortality curve during different periods of the epidemic did not run parallel with the morbidity curve.

The influenza bacilli may remain for a long time in the sputum in phthisical cases, especially in patients with pulmonary cavitation, whereas they generally disappear after a few days in a typical acute case arising in a previously healthy person.

In some cases the initial symptoms are extremely severe and sudden in onset. For example, the disease may be ushered in with convulsions, coma, severe vertigo, or even acute mental symptoms, and yet the patient may be well in a few days. As a rule, after an uncomplicated attack, the patient passes through a rapid convalescence ; but in other cases, when the course of the illness has been apparently in all respects identical, convalescence is extremely long and tedious, owing to great debility, loss of energy both bodily and mental, insomnia, anorexia, and gastric disturbance.

Influenza is prone to relapse after a few days' interval, and not very infrequently the relapse is much more serious than the original attack. Moreover, pulmonary trouble, which was at first absent, may now supervene. With reference to the pulmonary form, in addition to the prognostic points common to any form of pneumonia, a guarded prognosis should be given even when the temperature has fallen to normal, as it is not very unusual to have a second or even a third pneumonic attack following closely one on the other. A particularly fatal form is that of acute hyperæmia of the lungs, associated with dyspnoea and cyanosis, sometimes with sanguineous sputum, but without pneumonic change. Such patients very often die after a few days with cardiac asthenia and tachycardia.

In the recent epidemic, Bie found that in 55 patients whose influenzal pneumonia was complicated by heart disease, 31, i.e. 56 per cent, died, and that the mortality of patients with pneumonia and albuminuria was 35 per cent, contrasted with a mortality of 12 per cent in patients with pneumonia but without albuminuria. A respiration-rate of over 40 is of bad prognostic significance.

Heliotrope cyanosis is a very grave sign, even in the absence of other severe complications.

In some cases resolution of the pneumonic lung may be delayed for weeks, sometimes even for months, after which the lung may become completely clear. It is well, therefore,

not to be too premature in asserting that the patient is suffering from indurative pneumonia, or, if the lesion happens to be at the apex, that the patient is becoming tuberculous; the diagnosis in the latter case being made by radioscopy, repeated examination of the sputum, and the evolution of the disease. On the other hand, an influenzal infection certainly does not infrequently pave the way for a tuberculous lesion. Further, latent phthisis may become active, and healing foci break out afresh. Phthisical patients show a special predisposition to influenza, and influenzal patients to an increase of any tuberculous lesion present. Statistics, however, from several sanatoria during the recent epidemic showed a low incidence of influenza among the tuberculous patients.

With reference to the prognosis of influenzal encephalitis, it is usual for the resulting paralysis to clear up entirely if the patient does not succumb to the severity of the attack. The prognosis is grave in cases, occurring generally in children, which assume all the characters of meningitis, including convulsions, headache, vomiting, coma, cervical rigidity, strabismus, mydriasis, inequality of the pupils, grinding of teeth, bradycardia, and irregular respiration. According to some authors, the prognosis of influenzal epilepsy is decidedly better than in many other forms.

The prognosis of uncomplicated influenzal psychosis is as a rule favourable, but it may last for weeks, or even months. Even extreme organic involvement of the nervous system in influenza has a better prognosis in the majority of cases than similar conditions not due to this disease.

Influenza occasionally exerts its influence almost entirely on the heart, and when this occurs the outlook is very grave. There is great tendency to syncope; the pulse is rapid, irregular, and feeble, with pallor, precordial distress, and sometimes sweating. When recovery takes place, convalescence is extremely tedious as a rule, and is associated with prolonged disturbance of the heart's action: this is generally rapid and irregular, though sometimes bradycardia with intermittent action persists.

A fixation abscess, made by the injection of 1 or 2 c.c. of oil of turpentine into the subcutaneous tissues of the thigh, is a help in prognosis. If it takes satisfactorily and a vigorous reaction occurs, the chances of recovery are good. On the other hand, if the abscess does not take, it indicates an inability of the organism to respond to the injection.

A myelocythæmia frequently occurs in influenza, but this has not been found to have any prognostic significance.

The prognosis is better in cases of influenzal pneumonia which show a pronounced leucocytosis. Many of the fatal cases have a leucocyte count under 10,000.

Influenza tends to assume a very severe type in malarial patients. Influenzal pneumonia in conjunction with malaria has the gravest outlook. Glaessner found that in ten patients in whom this combination occurred only one recovered.

An attack of influenza influences patients suffering from diabetes very unfavourably, and they not infrequently die in coma. It may also lead to abortion in a pregnant woman, and in this way render the prognosis exceedingly grave if pneumonia is also present, and about 50 per cent of these patients die. J. W. Harris found in 1350 cases of influenza in pregnancy that the mortality was much higher (41 per cent) in cases complicated by abortion or premature labour than in the remainder, in which it was 16 per cent. In some rare cases, repeated rigors occur throughout the course of the illness. These may arise without the formation of pus, pneumonia, or obvious visceral changes, and although the prognosis must be guarded, owing to the severity of the cases, too gloomy an outlook should not be given.

(For mental symptoms, *see* MENTAL DISEASES.)

J. R. Charles.

INSANITY.—(*See* MENTAL DISEASES.)

INTERSTITIAL KERATITIS (Parenchymatous Keratitis).—This is an inflammation of the deeper layers of the cornea, associated with a varying degree of iritis and cyclitis. In the great majority of cases the disease is due to inherited syphilis. It is a rare occurrence in acquired syphilis; and of the remainder, tuberculosis is the commonest cause. In over 90 per cent of cases a positive Wassermann reaction is present. The age of the patient is usually between 5 and 20 years, although the disease is occasionally seen as late as 40.

Clinical Appearances.—The disease usually appears in one eye, as a patch of opacity, often triangular, at the margin of the cornea. The patch is grey in colour, and although the clouding is deep in the cornea, the surface over it is rough and dull. Other similar patches appear at other points of the corneal margin, and they spread towards the centre of the cornea. Eventually, the opacity may extend over the whole of the cornea, giving it the characteristic 'ground-glass' appearance, and the vision in the eye becomes reduced to 'finger-counting' or 'hand-movements'. As the opacity spreads into the cornea, this becomes vascularized by new blood-vessels which arise from the anterior ciliary vessels. When vascularization is marked, a 'salmon-patch' is produced. The inflammation then gradually subsides, and the cornea begins to clear. The margin of the cornea is the first to clear, and the centre the last.

In the less common type of the disease, the opacity begins as a number of grey spots at or near the centre of the cornea. These spread and coalesce, and involve the whole of the cornea. The subsequent course is similar to that of the other type, except that the central spots are rather more liable to remain opaque, and so interfere with vision.

The intra-ocular tension is almost always subnormal. In a few cases it is raised, and in these *keratectasia* is to be feared.

Short of this, slight bulging of the cornea, causing *myopia*, is not uncommon. In a series of 152 eyes with inherited interstitial keratitis, reported by Igersheimer, myopia resulted in one-third. A large 'salmon-patch' indicates a severe attack, and in a few cases, where the whole cornea has been vascularized, the resulting scarring causes *flattening of the cornea*. In these cases the end-result is that the cornea is completely white and opaque, and the vision is reduced to perception of light.

Effect of Age.—In young people the disease always affects both eyes. Usually the second eye is attacked two or three months after the onset of the disease in the first eye, but it may become involved earlier (even after a few days), or later. Occasionally, the eye first attacked is already quiet when the second becomes inflamed, and the course of the disease is even more protracted than usual; but as a rule the attack is less severe in the second eye, its duration is shorter, and better vision is regained. The younger the patient, the better is the prognosis as regards vision.

In delayed interstitial keratitis from inherited syphilis, and in interstitial keratitis from acquired syphilis, the disease is usually unilateral. Cases due to tuberculosis are probably always unilateral. In acquired syphilis the disease is less severe.

Duration.—In young people, the marginal patches of opacity may never reach the centre of the cornea, and the attack may be over in a few weeks, leaving no defect of vision; but the usual course is for the opacity to spread, and the eye to remain acutely injected, for two or three months. The inflammation then slowly subsides, and after six to nine months the eye is no longer red. During the period of subsidence, the opacity of the cornea begins to clear from the periphery inwards, but this clearing continues more slowly for many months, even as long as two years.

Mild relapses occur in 14 per cent of cases. They may occur months or years after the eye is quiet.

Complications.—There is always *iridocyclitis*. This may only manifest itself as a refusal of the pupil to dilate under atropine, or adhesions may form between iris and lens. These posterior synechiæ tend to prolong the disease. In cases due to acquired syphilis and to tuberculosis, it is common to find spots of deposit on the back of the cornea ('keratitis punctata'), but these usually disappear later and do not affect the end-result.

Keratectasia and *flattening of the cornea* have already been mentioned. The first named, if associated with increase of intra-ocular tension, may call for sclerectomy or trephining.

Results of Treatment.—Treatment, during the acute stage, chiefly consists in endeavouring to dilate the pupil with atropine, and in giving mercury, preferably by inunction or by intramuscular injection. It has, however, little effect on the course of the disease. It does not alter the Wassermann reaction, nor does it prevent the development of the disease in the second eye. It is generally agreed that salvarsan is valueless, although a few surgeons maintain that, if given repeatedly (12 to 15 injections), it shortens the disease.

The end-result as regards vision depends on the density of the opacity remaining in

the centre of the cornea, and much may be done towards clearing this, especially if treatment to this end is begun as soon as the stage of regression is reached. In the earlier stages dionin and subconjunctival injections are valuable; later, yellow oxide of mercury ointment and eserine are used, and may be continued with benefit for two or three years.

Igersheimer reports the visual results in 152 eyes. He found that 59 per cent obtained 'useful vision', which he defines as $1/5$ or better. This figure probably gives an unduly gloomy view of the prognosis, and it is probable that 60 per cent of the eyes retain as much as $6/18$, which vision is sufficient for reading, and for most manual work.

Arthur D. Griffith.

INTESTINAL OBSTRUCTION.—Under this heading we shall include cases of acute intestinal obstruction due to cancer, faecal impaction, bands, apertures, Meckel's diverticulum, and volvulus. Intussusception, strangulated hernia, and chronic obstruction due to cancer of the colon or rectum are dealt with in other articles.

The most essential element in the prognosis is to make a careful distinction between faecal impaction and organic obstruction. Many cases of simple impaction recover with ordinary treatment such as purgatives and enemata; when organic obstruction is present, recovery apart from operation is next to impossible. In practice, however, the distinction between the two may be extremely difficult, and most surgeons have seen a patient refuse a laparotomy, and recover nevertheless. Of course, if a mass of hard faeces can be felt in the rectum or colon, or if copious enemata immediately bring away a large evacuation, the diagnosis is clear. The difficult cases are constipated elderly people with a swollen or fat abdomen in which nothing can be felt, who have vomited once or twice, and are not relieved by enemata. It is much safer to explore the abdomen, if enemata fail and nothing can be felt in the rectum, without waiting to see if spontaneous recovery will take place.

It is probable that in a few rare instances the bowel has escaped, by some lucky accident, from an organic strangulation; but almost invariably it is paralyzed soon after it becomes ensnared. Still, these occurrences will lead a practitioner who values his reputation not to be too 'cock-sure' in threatening death to a patient who refuses operation. The practical rule, however, is that if repeated enemata fail, and vomiting, abdominal pain and distention, and constipation are present, death within a few days is all but certain, apart from operation. One ought not to wait for faecal vomiting; that is a death-door phenomenon. Patients with *foul* vomit may recover after operation; those with vomit smelling of faeces, very seldom. The most common cause of death is toxæmia, then peritonitis and lung complications. Death on the table from inhaling foul vomit is by no means a negligible cause of fatality.

Results of Operation.—It is not easy to gauge accurately the present-day mortality of intestinal obstruction treated by surgical means; cases are operated on at all stages, for so many types of obstruction, and in so many different ways. Some statistics, such as McGlannan's, and Deaver and Ross's, are complicated by the inclusion of a large number of strangulated hernia cases. They give the mortality as 45·7 and 42 per cent respectively. Both these series were published in 1915. By a combined study of the literature and hospital reports, Gibson published in 1910 the results of 646 cases, whereof 312 died, that is, 47 per cent. This includes patients with intussusception, but does not include cancer. Treves (1899) and Moynihan (1906) both agree that the actual mortality is probably 50 per cent, but Moynihan declares that this is a reproach, and that "anything over 10 per cent is the mortality of delay". In the St. Thomas's figures the death-rate in simple cases was 56·7 per cent, and in malignant cases 65 per cent.

Even more modern figures are not much better. At the New York Hospital, 1914 to 1918, there were 17 deaths after 36 operations. The results at the Bristol Royal Infirmary, 1914 to 1920, are worse still. It is remarkable that whilst cases of strangulated inguinal and femoral hernia, and of intussusception, have been getting sent up to the surgeon much more promptly during the past ten years with a consequent halving of the mortality, yet there has been no improvement in respect of intestinal obstruction and of strangulated umbilical hernia.

How much the time of operation influences the death-rate is shown by Gibson's figures, as given in the following table (the figures do not include intussusception, hernia, or cancer):—

MORTALITY ACCORDING TO DAY OF OPERATION.

Day of Operation	Cases	Died	Percentage
First - - -	16	6	37·0
Second - - -	44	17	38·5
Third - - -	61	25	41·0
Fourth - - -	70	27	38·5
Fifth - - -	62	30	48·0
Sixth - - -	44	29	66·0
Seventh - - -	28	15	53·5
Later - - -	107	59	55·0

Women do better than men (33 per cent die, as compared with 54 per cent—Gibson).

Age has some influence on the result. In Richardson's figures, infants did badly (73 per cent died); from 1–30 years, the death-rate was about 22 per cent; above the age of 30, it was over 50 per cent.

The Varieties of Obstruction.—We must now take up each form of obstruction separately.

Fæcal impaction and foreign bodies produce a form of obstruction which is relatively favourable, and which will usually yield to simple measures such as enemata. Death from fæcal impaction is very unusual, unless the patient is utterly neglected. It is astonishing how long one may survive without an action of the bowels; one patient, reported by Harris, was seen fifty-three days after the last evacuation!

Obstruction by bands or kinks is not favourable, because the small intestine is involved. The higher the block, the worse the outlook. According to Treves, the average length of life is about five days, the extremes being eight hours and twenty days. In Gibson's 186 cases, 41 per cent died. The treatment was usually division of the band; on 17 occasions resection was necessary; and an artificial anus was made in 22. Practically all these last died. Of 102 cases at St. Thomas's, 35 recovered and 67 died. In Deaver and Ross's series, of 81 cases, 49 per cent died. In Richardson's later series, the death-rate was 50 per cent.

Volvulus, when not treated by operation, has an average duration of six days, the extremes being sixty-four hours and twenty days (Treves). Corner and Sargent, reporting on 57 cases from St. Thomas's Hospital over many years, found 19 recoveries and 21 deaths. Gibson gives the death-rate as 54 per cent: when the loop was untwisted, 31 out of 79 died; when resected, 13 out of 16; when an artificial anus was made, the fatalities amounted to 16 out of 20.

Finsterer, using the published records of various German and Austrian surgeons, believes that resection gives better results than detorsion. In his whole series (up to 1912) of 110 cases, 37 per cent died; resection and immediate end-to-end anastomosis had a mortality, if the gut was not gangrenous, of only 7 per cent in 29 cases. It is difficult to accept this as a fair representation, however. Most surgeons consider end-to-end anastomosis in the presence of acute obstruction very dangerous. Finsterer's cases probably include a disproportionate number of published successes.

Jankowski has reported 5 cases of volvulus of the cæcum, of which 2 were cured and 3 died; he also reported 48 cases of volvulus of the pelvic colon operated on in Riga during ten years (1903–13). The results are shown in the following table:—

RESULTS OF OPERATION FOR VOLVULUS OF THE PELVIC COLON
(JANKOWSKI).

Operation	Cases	Cured	Died
Detorsion and fixation of mesocolon -	11	11	0
Enterotomy and fixation - - -	4	3	1
Short-circuiting (cæcum to rectum) -	6	1	5
Resection of loop - - -	3	2	1
Gangrene already present - - -	24	2	22

INTESTINAL OBSTRUCTION

In Richardson's second series in the following table, the death-rate from volvulus (16 cases) was only 25 per cent.

Gall-stone impaction, for some reason or other, is not as favourable as one would have thought. In Gibson's series of 40 cases, 57 per cent died. Wagner collected the literature reports up to 1914; of 334 cases, 161 were operated upon, and 62 per cent died. Of 173 not operated on, 93 passed the stone per anum and recovered; 80 died. Probably these statistics flatter the frequency of spontaneous evacuation of the stone.

Meckel's diverticulum caused obstruction in 42 of Gibson's cases, and 62 per cent died. Division or excision was practised 30 times, with 17 deaths; resection of bowel 5 times, with 4 deaths; and an artificial anus was made in 4 cases, with 3 deaths. At St. Thomas's Hospital, 14 out of 22 died; at Massachusetts Hospital, 9 out of 13.

Two series from the Massachusetts General Hospital have been published, the first by Scudder, 1898-1907, and the second by Richardson, 1908-1917. In Scudder's series, of 121 cases, 60 per cent died; in Richardson's 118 cases, the death-rate had fallen to 41·5 per cent.

MORTALITY ACCORDING TO FORM OF OBSTRUCTION.

Type of Case	1898-1907				1908-1917			
	Cases	Recovered	Died	Mortality per cent	Cases	Recovered	Died	Mortality per cent
Early post-operative obstruction (first 4 weeks after operation)	18	5	13	72·2	29	22	7	24·1
Late post-operative obstruction (developing after 4 weeks)	19	13	6	31·6	28	17	11	39·3
Bands and adhesions (without previous operation)	33	15	18	54·5	14	7	7	50·0
Meckel's diverticulum	9	2	7	77·7	4	2	2	50·0
Volvulus	9	0	9	100·0	16	12	4	25·0
Intussusception	27	13	14	51·8	20	8	12	60·0
Mesenteric thrombosis	1	0	1	100·0	5	1	4	80·0
Congenital anomalies	2	0	2	100·0	—	—	—	—
Stone in gut	1	0	1	100·0	1	0	1	100·0
Internal hernia	2	0	2	100·0	1	0	1	100·0
Totals	121	48	73	60·4	118	69	49	41·5

Incarceration in openings or retroperitoneal hernia is also a serious condition. In Gibson's series of 34 cases, 62 per cent died. During the past eight years, however, of 15 cases found in the literature, 10 were cured by operation, including one of my own.

RESULTS OF OPERATION FOR INTESTINAL OBSTRUCTION AT ST. THOMAS'S HOSPITAL, 1887-1907.

Nature	Total	Recovered	Died	Mortality per cent
Intussusception	202	109	93	46·0
Volvulus	29	10	19	65·5
Broad peritoneal adhesions	60	24	36	60·0
Cicatricial bands	42	11	31	74·0
Mesenteric holes	5	0	5	100·0
Meckel's diverticulum	22	8	14	64·0
Cicatricial stricture	9	1	8	89·0
Gall-stone impaction	5	1	4	80·0
Various	26	9	17	65·0
Malignant disease of bowel	400	173	227	56·7
	137	48	89	65·0

A cancerous growth is, unhappily, one of the commonest forms of acute intestinal obstruction. At St. Thomas's Hospital, out of 137 such cases, 65 per cent died. The

growth in the great majority was situated in the pelvic colon or rectum. In Paul's series of 24 private cases, treated by colostomy, 9 were fatal. Of 23 cases at the Bristol Royal Infirmary all suffering from acute obstruction, and excluding patients with a band, hernia, gall-stone, volvulus, or intussusception, 6 died; these were nearly all suffering from cancer of the bowel treated by colostomy. (For further progress of the cases, see COLON, CARCINOMA OF.)

The Prognosis in Individual Cases.—The principal factors in judging the prognosis in any particular case are (1) *The time of operation*; (2) *The nature and frequency of the vomiting*; and (3) *The presence or absence of gangrene when the abdomen is opened*.

1. *The importance of early operation* has already been emphasized. The first two days are relatively favourable; after the fifth day the chances are against survival.

2. *The nature and frequency of the vomiting* is very important. A high-up obstruction, near the duodenum, causes very frequent and urgent vomiting, without much distention of the abdomen, and the vomit becomes foul but not faecal; these cases are very fatal unless operated on early. When the obstruction is low down in the colon or rectum, vomiting is late and infrequent, and there is more time before the patient passes beyond the reach of surgical help. If the vomit becomes foul, the outlook is grave; if faecal, it is almost hopeless. 3. *If a gangrenous area* is found at the operation, the chances of recovery are small, but not hopeless.

A 'chesty' patient, or one suffering from grave toxæmia, is not likely to be saved, and the advent of peritonitis is practically a death warrant.

The method of giving the anæsthetic and of conducting the operation counts for something. If there is incessant vomiting or bronchitis, intraspinal or local anæsthesia is probably safer. It is very important to operate quickly, and to empty the distended, paralyzed coils of bowel by Moynihan's tube or some similar device. Physostigmine salicylate and pituitary extract will probably reduce the mortality a little by averting post-operative intestinal palsy.

REFERENCES.—Gibson, *Ann. of Surg.* 1900, xxxii, 486; Treves, *Intestinal Obstruction*, 1899; Moynihan, *Abdominal Operations*, 1906; Finsterer, *Arch. f. klin. Chir.* 1912, 910; Paul, *Brit. Med. Jour.* 1912, ii, 172; Jankowski, *Deut. Zeits. f. Chir.* 1913, Sept.; Makins, *Burghard's System of Operative Surgery*, ii, 521; Deaver and Ross, *Ann. of Surg.* 1915, lxi, 198; McGlannan, *Jour. Amer. Med. Assoc.* 1915, lxxv, 673; Gibson, *Trans. Amer. Surg. Assoc.* 1919, 429; Richardson, *Boston Med. and Surg. Jour.* 1920, clxxxiii, 288; Wagner, *Deut. Zeits. f. Chir.* 1914, cxxx, 353.

A. Rendle Short.

INTESTINE, INJURIES OF.—(See ABDOMINAL INJURIES; GUNSHOT WOUNDS.)

INTRACRANIAL COMPLICATIONS OF EAR DISEASE.—It is stated by Haseler that of 81,684 cases of suppurative otitis media, 116 died of various intracranial complications (lateral sinus thrombosis 48, meningitis 40, abscess 28), a percentage of about 0.14. Some London figures agree with this. The risk, therefore, is about 1 in 700. It is very difficult to find in the literature a sufficient number of reliable records by which we may judge the prognosis of these affections. Some statistics are altogether too favourable; in others a few successes have been reported and many failures overlooked. It must be remembered that, in practice, two intracranial complications often exist together, and obscure both the diagnosis and the prognosis.

Lateral Sinus Thrombosis.—Apart from operation, these patients nearly all die of pyæmia or meningitis, the duration of life varying from two to six weeks. Natural recovery does occasionally take place, but it is rare; the writer has seen one case. The prognosis depends upon early operation, but patients may occasionally be saved even after abscesses have formed in the lungs.

According to Hunter Tod, about a third of the patients operated on recover. Macewen's results were much better than this (20 out of 28). At the Bristol Royal Infirmary, 5 patients out of 11 recovered; some of the fatal cases had an abscess as well. No doubt earlier diagnosis would improve the prospects very much.

I have interviewed three patients some years afterwards. One was quite cured; another suffered for months from pyæmia, and then recovered except for otorrhœa; the third complained of persistent giddiness, due to labyrinthitis.

Extradural Abscess.—All five of Macewen's cases recovered; but in practice many of these patients die, in spite of operation.

Abscess of the Cerebellum or Temporosphenoidal Lobe.—Unfortunately the difficulties of diagnosis, especially of cerebellar abscess, are very great. The classical signs, nystagmus, ataxia, or atonia, are very frequently absent; optic neuritis is inconstant; and the subnormal temperature is only present in about half the cases. At the Bristol Royal Infirmary during ten years, 6 cases of cerebellar abscess were missed, but of 8 cases of temporosphenoidal abscess a successful diagnosis was made in every instance.

**MORTALITY IN CASES OF INTRACRANIAL COMPLICATIONS OF EAR DISEASE
TREATED BY OPERATION.**

REPORTER	LATERAL SINUS THROMBOSIS			CEREBRAL ABSCESS			CEREBELLAR ABSCESS		
	Cases	Deaths	Recoveries	Cases	Deaths	Recoveries	Cases	Deaths	Recoveries
Macewen - - -	28	8	20	9	1	8	4	0	4
Henke - - -	—	—	—	37	20	17	10	9	1
Bristol Royal Infirmary	11	6	5	10	7	3	4	4	0
Politzer's Clinic - -	—	—	—	—	—	—	28	21	7
Milligan - - -	—	—	—	—	—	—	27	10	17

In our experience, the main point in the prognosis is to operate within three days of the onset of drowsiness (not coma). Of 4 cases so treated, 3 recovered; later than the third day none recovered.

The prognosis after operation is very much better in temporosphenoidal than in cerebellar abscess. Once again Macewen's results are much better than those ordinarily obtained; but according to the statistics of Henke and of the Bristol Royal Infirmary, from a third to half of the patients may be saved in cerebral cases, and a quarter or less (7 out of 28 in Politzer's clinic) of the sufferers from cerebellar abscess. Of 100 patients treated at the London Hospital during ten years, 20 temporosphenoidal and 10 cerebellar cases recovered; probably this is abnormally bad. Milligan's series of 27 operations for cerebellar abscess at Manchester during ten years is very gratifying, 17 being saved and 10 dying.

After operation the patient may remain in a drowsy state for days, and yet recover if the pulse and temperature are normal; but symptoms often return and end fatally.

If the patient recovers, there is some fear of persistent liability to convulsions; the writer has seen one such case.

Meningitis.—The onset of evidence of meningitis (head retraction, Kernig's sign, nerve palsies, irregular fever) is usually a death warrant, but a few cases have undoubtedly been saved. Macewen operated on 6 out of 12 cases where there was intracranial meningitis only, and saved them all; only 1 out of 6 patients with cerebrospinal meningitis recovered.

The writer has seen a case saved by operation and drainage, combined with repeated lumbar puncture. Urotropine probably helps.

REFERENCES.—Macewen, *Pyogenic Diseases of the Brain and Spinal Cord*; Neumann, *Cerebellar Abscess* (Lake's translation); Hunter Tod, "Intracranial Complications of Ear Disease", *Burghard's System of Operative Surgery*, iv, 429; Milligan, *Brit. Med. Jour.* 1914, ii, 833. A. Rendle Short.

INTUSSUSCEPTION.—It will be necessary to consider, first, the acute intussusceptions, usually of children; and, secondly, the chronic intussusceptions of adults.

Acute Intussusception.—There is a *natural cure* of intussusception by sloughing of the intussusceptum. It is very difficult to arrive at any idea of its true frequency. Wiggins (quoted by Childe) puts the spontaneous cures at approximately 1 per cent; but there is always the probability that such a curiosity would turn up with undue frequency in the medical literature. The main point is that it is an event of excessive rarity in infancy; only 8 per cent of the recorded cases were in children under eight years of age. In adults it is not so very infrequent, and the slough may come away several weeks afterwards. A few cases die (said to be 3 per cent) even after passage of

the slough. Apart from this very exceptional occurrence, the average length of life, in infants, is about three days. Cases have died within nine hours. Three or four reports in the literature appear to suggest that an intussusception may in very rare cases reduce itself spontaneously. I have seen one in a young man, verified by operation, which seemed very convincing. Several inches of the ascending colon remained swollen, red, and oedematous. The symptoms were characteristic, and lasted about twelve hours.

Cure by Injection of Water is now attempted by very few surgeons, because it often fails even in early cases, and it is impossible to tell for many hours whether it has succeeded or not, so that the necessary operation may be dangerously delayed. Clubbe, of Sydney, tried it in 138 cases, but it was only successful in 14 of these (10 per cent).

In Copenhagen, it is apparently the routine to treat cases of intussusception by injection of water under an anæsthetic, even two or three days after the onset. Koch and Oerum have furnished details of 397 cases, 60 per cent under twelve months old, treated between 1880 and 1909. One to two pints are injected with an enema syringe, and then taxis is used. Deep anæsthesia is required. In 2 cases the bowel was ruptured. In the worst cases only, a primary operation is performed. If the injection fails, a secondary operation is undertaken.

RESULTS OF TREATMENT IN COPENHAGEN BY INJECTION UNDER CHLOROFORM.

	Cases	Cured by injection	Failed and had operation		Total Cured	Total Died
			Lived	Died		
Under 12 months	187	87	13	39	100	87
Over 12 months	114	65	24	16	89	25
Totals	301	152	37	55	189 = 63%	112 = 37%

Set forth as they are in the authors' tables, the results of injection of course appear to be much better than those of operation. We have recalculated the figures according to the data furnished, so as to be able to compare the consequences with those of the English school of practice.

It will be observed, first, that about half the cases are capable of cure by injection and taxis under an anæsthetic, but secondly, that the eventual results are not so good as the figures furnished by modern hospital operative treatment, where recoveries amount to nearly 80 per cent. When it is remembered that the injection method was only used for the more favourable type of patients, and that in 65 graver cases primary operation was performed, it is clear that the Danish figures do not establish a powerful argument for bloodless measures. It must further be borne in mind that perhaps a few recoveries were not cases of intussusception at all. If it is possible to administer an anæsthetic, it is usually also possible to operate.

Reduction of the Intussusception by Operation is the routine treatment. Judging by the published statistics at the time of our first edition, about two-thirds of the cases recovered and one-third died, but at the present time the true mortality ought not to exceed 20 per cent if practitioners do not waste time in getting their patients operated on. Records are given in the table of 59 children treated by reduction at St. Bartholomew's Hospital from 1901 to 1911, and 124 cases operated on by Clubbe. The St. Thomas's Hospital figures for twenty years running up to 1918, 374 in all, show a mortality of 32 per cent, but during the last five-year period only 19 per cent died. Gallie's series from the Toronto Children's Hospital represent a deplorably late type of case; 17 out of 45 were irreducible, and all died. Of 28 reducible, in 18 the reduction was easy and 14 got well; in 10 it was difficult, and only 2 lived.

Perrin and Lindsay report 400 cases from the London Hospital, 1903 to 1920, with a death-rate of 35 per cent. Excluding resections, the death-rate in 309 cases reducible by manipulation was 22 per cent.

Two series are also shown from the Bristol Royal Infirmary, the first running from 1903 to 1912, and the second the cases operated on by three assistant surgeons from 1914 to 1920. All ages are included ; in the early series the death-rate was 39 per cent ; in the later, 22 per cent. Some of these, of course, were all but hopeless cases ; one was sent in from the country on the fifth day, and died. One child with gangrenous gut recovered after resection, as noted below.

TABLE OF CASES OF ACUTE INTUSSUSCEPTION TREATED BY
LAPAROTOMY AND REDUCTION.

Hospital	Cases	Recovered	Died
St. Bartholomew's Hospital* - -	59	46 = 78%	13 = 22%
Clubbe† - - - -	116	83 = 73%	33 = 29%
St. Thomas's Hospital† - - -	374	253 = 68%	121 = 32%
Last five years - - - -	—	—	= 19%
London Hospital, 1903-20 - -	400	261 = 65%	139 = 35%
Children's Hospital, Toronto* - -	45	16 = 36%	29 = 64%
Bristol Royal Infirmary†, 1903-12 -	46	28 = 61%	18 = 39%
" " " 1914-20 -	23	18 = 78%	5 = 22%

* Children only. † All ages.

The success of treatment depends principally upon early diagnosis. Childe quotes 123 Glasgow cases, of which—

Operation within 6 hours gave	- -	60.0 per cent cured
" " 6 to 12 hours gave	73.3	" "
" " 12 to 24 " "	57.5	" "
" " 24 to 48 " "	26.6	" "

In the London Hospital series, the death-rate and the number of resections needed in each triennial period from 1903 to 1920 run parallel to the delay in operating ; in 1915-16-17 the duration of symptoms averaged 26 hours, and 19.5 per cent died ; in 1903-4-5 the symptoms averaged 46 hours, and 59 per cent died.

Acute cases operated on after forty-eight hours nearly all die ; but there is a more chronic type, in which the results are fairly favourable ; thus, 8 out of 12 such at St. Bartholomew's recovered. The higher death-rate within the first six hours than in the next six-hourly period is a common phenomenon in the records of abdominal surgery ; it must not be used as a plea for delay, as it means no more than that the ultra-acute cases are soonest diagnosed.

Prognosis in older persons is worse than in infants ; thus, in the St. Bartholomew's Hospital series, of the patients over two years, 9 out of 19 died, and of those under two, only 24 out of 68.

Treatment by Resection is a last-resort method, and usually leads to a fatal result. There are a few instances of successes on record. At the discussion in 1910 at the Royal Society of Medicine, 4 cures were mentioned : 2, age two and four respectively, at the Queen's Hospital for Children, and 1, age seven months, at Great Ormond Street, under spinal analgesia. Clubbe reports a recovery in a child of eleven months ; 7 other resected cases all died. I have had one successful case in a boy of six, and have seen a recovery in a young man in whom five feet of gut were resected by Hey Groves.

Four out of 24 resection cases, all patients over a year old, recovered in the Copenhagen series. In the big London Hospital series only 9 resections out of 49 recovered ; all were above three years of age.

Relapse is uncommon. The only case which has come under the writer's notice is one in which an appendicostomy was performed, partly for feeding purposes, and partly to prevent relapse !

Intussusception babies have an extraordinary liability to burst their stitches. Fortunately, though a second operation is called for, they generally recover.

Prognosis in Individual Cases depends largely upon the length of time before treatment is instituted; over twenty-four hours turns the chances against the child. Much vomiting, listlessness and lack of interest, and a depressed fontanelle are all grave signs. According to the London Hospital figures, the enteric type is the most dangerous (55 per cent died); the ileocæcal and ileocolic are intermediate (about 30 per cent died); the colic is the least dangerous (16 per cent died).

Chronic Intussusception.—This rare disease is usually of grave import, because it is likely to be diagnosed late, and reduction will probably be impossible. Of 6 cases treated by resection at St. Bartholomew's Hospital (1873–1908), 1 recovered and 5 died.

Maxwell, of Formosa, reports 6 cases there, whereof 3, treated by lateral anastomosis, recovered, and 3 died. The writer has seen one case which was resected, but died. It would, therefore, appear to be better to leave the intussusception and do a short-circuiting lateral anastomosis.

REFERENCES.—Clubbe, *On Intussusception*; Childe, "Diseases of Children", *Proc. Roy. Soc. Med.* 1910, vol. iii, pt. 1, 165; Eccles, *St. Bart's Hosp. Rep.* 1911, 97; Maxwell, *Ibid.* 1908, 153; Koch and Oerum, *Edin. Med. Jour.* 1912, ix, 227; Makins, *Burghard's System of Operative Surgery*, vol. ii, 521; Romanis, *Practitioner*, 1918, Sept.; Gallie, *Canad. Jour. of Med. and Surg.* 1916, xl, 58; Perrin and Lindsay, *Brit. Jour. Surg.* 1921, July, 46.

A. Rendle Short.

IRRITABLE HEART.—(See HEART, IRRITABLE.)

ISCHÆMIC CONTRACTURE.—(See MUSCULAR ATROPHIES.)

JAWS, TUMOURS OF.—We shall follow the example of most writers, and discuss the prognosis of diseases of the upper and lower jaws separately, at least as far as malignant disease is concerned.

Epulis.—There is some difference of opinion as to what is meant by a 'simple' epulis. Under this name the older writers described what they took to be a fibroma. According to Eve, out of 17 cases microscoped at the London Hospital, 2 were fibrosarcoma, 8 were myeloid, and 7 were granulation tissue; he doubts, therefore, whether there is any such thing as a fibrous epulis. In Kühner's series, out of 30 microscoped there were 2 fibromas; of the remainder, 20 proved to be myeloid, 7 sarcoma, and 1 granulation tissue. Both these statistics refer to surgical clinics; in the reports of dental clinics, where the smaller and more chronic growths are likely to be seen, fibrous epulis is much commoner.

If, then, we take epulis to mean a tumour of the gum, the majority of the cases will be myeloid or fibrosarcoma. Nevertheless, the end-results appear to be very satisfactory if an efficient operation is done in the first place—that is, if a small margin of healthy bone is removed together with the growth. It is not usually necessary to divide the lower jaw, or to encroach on the antrum, but even if this has to be done, as in a case of the writer's, it is remarkable how the antrum fills up in time, so that a small addition to a dental plate closes it effectually. The operation has almost no mortality.

END-RESULTS OF OPERATION FOR EPULIS.

Reporter	Cases	Died of operation	Relapsed
Eve, London Hospital -	30	0	6
Kühner, Tübingen clinic -	79	0	7

Of the 7 recurrences at the Tübingen clinic, 5 were cured by a second operation; in 2 patients death followed recurrence. The microscopical findings in 30 of the cases are quoted above. We have evidence, therefore, that even a so-called malignant epulis can usually be cured by a small operation—namely, removal of the portion of the alveolar process containing it.

Tumours of the Upper Jaw.—Coming now to the consideration of tumours involving the body of the jaw, or growing from the antrum, we find a very much graver state of affairs. There are a number of published records on which to base an opinion as to

the prognosis, mostly German and derived from a study of the end-results in various university clinics.

These growths are nearly all cancer or sarcoma, and apart from operation are as a rule fatal in from six months to two years. According to Ewing and American pathologists, the round-celled growths of the antrum which used to be called sarcomas are really cancerous. The usual treatment is by partial or complete removal of the maxilla. Gland involvement is somewhat late, and only occurs in about one-third of the cases, so that it is not always necessary to clear the lymphatic area in the neck.

The growths show three stages successively : (1) *Stage of latency*, with neuralgia, discharge from the nose, epistaxis, and polypi protruding into the nose ; (2) *Stage of deformation*, when the walls of the antrum begin to bulge ; (3) *Stage of invasion*, when surrounding structures such as the orbit, cheek, or palate become involved, or metastases appear.

The mortality of removal of the superior maxilla is undoubtedly high. The figures for three London hospitals from 1886 to 1897 give a death-rate of only 12·6 per cent in 127 cases, but this probably includes a good many partial operations. The carefully described records of Eve, Butlin, and the Göttingen clinic under Koenig, running up to 1897, are more worthy of confidence, and these show a mortality of 16·6, 28·5, and 32 per cent respectively. Eve's figures are more recent (1907), and he practises a preliminary laryngotomy. Krönlein's estimate from the literature since 1875 is probably the most reliable figure we have for present-day surgery, and we therefore conclude that the mortality is about one in four or five. Even Ochsner's quite recent figures, published in 1918, show a 20 per cent death-rate. A partial resection is, of course, less dangerous. The fatalities are usually from pulmonary complications.

OPERATION-MORTALITY AND END-RESULTS OF REMOVAL
OF SUPERIOR MAXILLA FOR MALIGNANT GROWTHS.

Reporter	Cases	Operation-mortality	Cases followed	Cured	Recurred
		per cent			
Eve - - -	12	16·6	—	—	—
Butlin - - -	14	28·5	10	5	5
Krönlein (literature) - -	158	21·5	—	—	—
Three London hospitals -	127	12·6	—	—	—
Greifswald clinic - - -	—	—	17	0	17
Estlander's clinic - - -	—	—	12	2	10
Göttingen clinic - - -	72	32·0	49	16	33
Berlin clinic - - -	—	—	47	5	42
Von Bergmann's clinic - -	—	—	21	6	15
Erlangen clinic - - -	—	—	17	1	16
Ochsner - - -	100	20·0	—	—	15
Davis - - -	—	—	9	3	6
Total - - -			182	38 (or 21 per cent)	159 (or 87 per cent)

Turning now to the *prospects of cure*, we find here also plenty of room for improvement. Butlin records 10 cases, of which 5 recurred, 2 were alive and well less than three years, and 3 were alive and well more than three years afterwards—but in one of these the diagnosis was doubtful; two patients with epithelioma appeared to be cured, though the orbital plate was left. In the Greifswald clinic no cases out of 17, at the Erlangen clinic 1 out of 16, and in Estlander's clinic 2 out of 12, were successful. At von Bergmann's clinic 13 cases of epithelioma were operated on without success; but of 8 cases of sarcoma, 6 were apparently cured. In the Berlin clinic only 5 out of 47 were cured by a total resection; but when partial removal could be practised, half the patients were cured. The most detailed figures available, albeit rather old now, are from the Göttingen clinic up to 1897, where, of cases recovering from the operation, 16 out of 49 were apparently cured; of these, 14 were followed over three years (up to eighteen years in one instance), and 2 less than three years. The microscopical report on these 16 growths showed 8 epithelioma, 4 myeloid, 3 sarcoma, and 1 endothelioma. In the cancerous cases the orbital plate was always removed, because it was found

that recurrence followed if this was not done. In non-cancerous cases the plate was sometimes left; of 13 such, 1 died of the operation, 7 recurred, and 5 were apparently cured (2 under, 3 over, three years).

Ochsner's series of 100 cases operated on personally at the Augustana Hospital includes 47 growths involving the lower jaw, 25 the upper, and 6 the antrum. Of these, 67 were carcinoma, 16 each epulis and sarcoma, and 1 chondrosarcoma. Twenty died in hospital, all carcinoma. It was known that 15 recurred (10 once, 1 twice, 4 three times), but how many were cured and how long they were followed up is not stated.

In a short series of 13 cases reported by Davis, 6 recurred, 4 were lost sight of, and 3 were alive and well from one to two-and-a-half years afterwards.

We may conclude, therefore, that in cases of malignant disease calling for removal of the upper jaw, about 1 in 5 is likely to be cured. The cancer cases are more serious than those with sarcoma or myeloid. In the great majority, recurrence takes place within four months, and death in a year.

A serious deformity is, of course, left by the operation, and an artificial jaw will be required. Also, if the orbital plate is removed, the eye may drop and cause diplopia.

To summarize, we may estimate that of 100 patients with growths of the upper jaw treated by operation, about 22 will die of the surgical procedure, and about 16 will obtain lasting cure—rather more in the sarcomatous group and rather less in the cancerous.

Tumours of the Lower Jaw.—The material for judging the prognosis in this variety of malignant disease is old and inadequate. Butlin has collected the records of 60 cases of excision of the lower jaw, with 8 fatalities. The growths which call for the operation are periosteal sarcoma, myeloid sarcoma, and epithelial odontome. Of 11 cases of periosteal sarcoma collected from the literature by Butlin, 1 was well nearly three years after, 1 died of pneumonia within a year, and 9 recurred. Of 43 cases of myeloid, 8 died of the operation, 2 recurred, 30 were not followed up, and 13 were 'cured'—but only 4 of these were followed three years. I have seen two children with periosteal sarcoma treated by excision of half the jaw, well after four years, and a man with epithelioma who had a segment of the jaw resected, well after three years. Of two cases of myeloid of my own, one was cured by excision of a segment of jaw and a very satisfactory prosthesis was fitted; another recurred after scooping out, but was cured by excision. Both have been followed over three years. Apparently, therefore, the prognosis in cases of growth of the lower jaw is better than that for corresponding tumours in the maxilla.

As in the case of the upper jaw, grave deformity follows the operation, but it can be remedied by the application of a dental prosthesis, even to such a degree that the patient may be able to bite an apple; or a piece of rib may be grafted in.

REFERENCES.—Eve, *Brit. Med. Jour.* 1907, i, 1525; Butlin, *The Operative Surgery of Malignant Disease*, 2nd ed., 1900; Fagge, "Diseases of the Jaws," *Burghard's System of Operative Surgery*; Ochsner, *Trans. Amer. Surg. Assoc.* 1918, xxxvi, 357; Davis, *Lancet*, 1920, cxcix, 1090.

A. Rendle Short.

JOINTS, CHARCOT'S.—(See CHARCOT'S JOINTS; TABES DORSALIS.)

JOINTS, INJURIES OF (see also GUNSHOT WOUNDS; HIP, CONGENITAL DISLOCATION OF; KNEE-JOINT, INJURIES OF).—We shall treat the subject under three headings: (1) *Sprains*; (2) *Dislocations*; and (3) *Perforating wounds*.

1. **Sprains.**—An ordinary sprained ankle, wrist, or other joint, given proper treatment such as rest, cold, and compression at first, and massage and movements later, will recover completely in a month or two. Trifling injuries will be well in a correspondingly shorter time. There are, however, certain exceptions to the rule.

The first of these is the *sprain-fracture*. Not at all an uncommon injury is a so-called sprained wrist accompanied by a fracture of one of the carpal bones, notably the scaphoid. This accounts for a large proportion of those cases in which pain, stiffness, or discomfort persists for years. The diagnosis is made, even after a long interval, by skiagram. If recognized early, something may be done to avert the prolonged disability, by advising against all movement, and fixing the wrist in the hyperextended position on a splint for a month, taking care to reduce any deformity, if necessary by open operation.

A second obstacle in the way of a confident prognosis is the possibility of the development of some form of *arthritis*. Rarely, tuberculous joint disease may follow the injury.

More often, and especially in the shoulder, a traumatic arthritis may make itself evident a few weeks after the sprain; there is marked tenderness over the coracoid, and limitation of movement in all directions. It is very important not to attempt to treat this condition by forcible movement, or it may go on to permanent incapacity. The proper treatment is rest. But in any case the trouble is likely to remain for a long time, and there will probably be some loss of range of movement. In another form, osteo-arthritis may follow injury to a hip- or knee-joint. In all probability there was already some disease present, and grating may be found in the uninjured knee, but the blow lights it up into activity, and a more or less permanent disability may follow. Some of these cases are due to the separation of a loose body.

A third source of disappointment is *the formation of adhesions*. This can and ought to be prevented by early recognition of the nature of the limitation of movement. It calls for exercises, and if necessary the breaking down of the adhesions under gas. In the case of the shoulder-joint, there is tenderness on direct pressure over the coracoid, and movements are more painful in one direction than in another. This distinguishes it from the arthritis just described. No joint ought to be moved whilst there is still synovitis, heat, or redness in or about it.

Given early diagnosis, including a skiagram, and proper treatment, the surgeon is able to give a fairly accurate prognosis, except for the unknown factor of arthritis; this cannot be foretold, but it may only too probably occur if the patient is known to be 'gouty' or 'rheumatic' in the old-fashioned sense.

Aged persons usually do not recover well.

2. Dislocations.—*Apart from treatment*, a dislocation is bound to lead to a great deal of disability; but in the case of the shoulder-joint, in young adults at any rate, a very fair degree of usefulness is often recovered.

Late excision for unreduced dislocation, or operative replacement, gives results much less favourable than those of immediate bloodless reduction, but sometimes a very fairly useful joint is obtained, and, at the shoulder, rotation even may be preserved. Scudder and Barney¹ report 11 cases of unreduced dislocation of the shoulder treated by excision and examined several years afterwards. Of these, rather more than half obtained a fair, but not perfect, result. There was always marked limitation of movement. The best success was obtained in a child.

Immediate reduction by manipulation is, of course, the best treatment when possible, and in the majority of cases leads in the course of two or three months to a perfect cure, at any rate in patients under thirty, and given proper treatment after reduction. Of 16 adult cases of dislocation of the shoulder investigated as to the end-results at the London Hospital,² 10 obtained a good result, 5 fair, and 1 bad. Korteweg,³ reporting on the end-results of 845 cases of dislocated shoulder coming under the German Government Insurance Department, 1904–12, found permanent incapacity in 10 per cent, and some disability in another 10 per cent who were able to do some work. He reports that better results were obtained in Holland by the Marbaix treatment, which dispenses with immobilization and orders early movements. On this method the average time of treatment was reduced to 55 days. Elbow cases in children may be said to do very well; in middle-aged or elderly people there will probably be some permanent limitation of movement.

A too favourable prognosis, however, has to be guarded against, because each of the complicating factors which we have passed in review as spoiling the prospects of a cure after a sprain may also be operative after a dislocation. There are two other unfavourable conditions to be added to the list: first, after some dislocations, and especially those of the hip, *the muscles may be so torn* as to lead to permanent lameness; and second, dislocations of the shoulder, jaw, patella, and clavicle sometimes show a remarkable *tendency to relapse*.

In the case of the clavicle and patella relapse is not very serious, but it may become a great nuisance to the patient if the jaw or the shoulder keeps on getting out of joint. It is related that a certain famous barrister was subject to the former affliction, and used sometimes to be taken when in the act of addressing 'my lord' or the jury: on which occasions he used to envelop his face in a handkerchief as though overcome by emotion, and hurry from the court. He acquired the reputation of being full of sympathy for the woes of his clients.

Recurrent dislocation of the shoulder is prone to occur in epileptics. Thomas⁴ has recently published a series of 18 shoulders treated by taking a reef in the capsule. In 13 of these a cure was obtained; in 3 others a further dislocation occurred, but only as a result of severe injury, such as in wrestling; in 2 cases the operation was not successful. Thomas makes use of a posterior approach to the joint. I was very well pleased with the end-result, seen eighteen months after, in a case of my own dislocated eleven times. The suggestion has recently been made to insert a band of fascia lata through a hole in the head of the humerus, and tie it up to the acromion.

Dislocation of the elbow is sometimes followed by traumatic myositis ossificans in the brachialis anticus muscle.

3. Perforating Wounds.—Given immediate diagnosis, and thorough cleansing within a few hours, more or less perfect recovery can usually be obtained, with at worst a certain amount of stiffness.

Many wounds of joints do not lead to suppuration, and the prognosis is then approximately that of a sprain. But if septic arthritis makes its appearance—usually by the third or fourth day—the outlook as regards the joint is grave indeed, and even the patient's life may be in jeopardy. Repeated incisions for drainage may fail to give relief, pyæmia often supervenes, and at last in despair both patient and surgeon are glad to end the struggle by an amputation. If this is avoided, bony ankylosis will probably take place, with or without displacement. (*See also GUNSHOT WOUNDS.*)

REFERENCES.—¹Scudder and Barney, *Ann. of Surg.* 1909, xlix, 696; ²Warren, *Lancet*, 1909, ii, 138, 219; ³Korteweg, *Centralb. f. Chir.* 1916, No. 46, 926; ⁴Thomas, *Surg. Gynecol. and Obst.* 1914, xviii, 107.

A. Rendle Short.

JOINTS, SYPHILITIC.—(*See SYPHILITIC JOINTS.*)

JOINTS, TUBERCULOUS.—(*See ARTHRITIS, TUBERCULOUS.*)

KALA-AZAR.—This term was first applied to the epidemic fever which carried off about one-third of the inhabitants over some two hundred miles of country in Assam in the course of twenty years. The mortality among several hundred carefully recorded cases of Dodds Price, on tea gardens, varied from 96 per cent early in the outbreak to 78 per cent latterly, the disease being thus almost as deadly as sleeping sickness. Subsequently kala-azar was found to be endemic in Bengal, Bihar, and parts of Madras (having been previously confused with malarial cachexia), the case mortality in Bengal being certainly less than in the Assam epidemic; but accurate figures cannot be given, as only the worst cases come to hospital, and it is very probable that a fair proportion of the more chronic cases recover spontaneously; it is probably about 75 per cent. A form of the disease especially affecting children occurs in North Africa; the mortality is less than in the Indian variety.

Death rarely occurs from the actual fever, but nearly always from some complication, of which the most deadly are cancrum oris (especially in children) and other septic infections, pneumonia, dysentery (usually bacillary), cirrhosis of the liver, hæmorrhages, and occasionally phthisis, all of which are extremely fatal in emaciated kala-azar subjects. In Calcutta, 82·5 per cent of fatal cases showed some such terminal affection post mortem.

Apart from such complications, unfavourable signs are extreme emaciation with persistent loss of weight, especially if diarrhœa is present; great enlargement of the liver, as well as of the spleen, with dilatation of the veins of the anterior abdominal wall, sometimes with ascites, indicating cirrhosis of the liver; œdema of the lower extremities; petechial hæmorrhages in the skin; and great anæmia.

By far the most important aid to the prognosis is the degree of leucopenia present, and especially the reduction in the total number of polynuclear leucocytes. Cases showing 1000 or less leucocytes, and still more those with under 250 total polynuclears per cubic millimetre, rarely recover, while the prognosis improves with every increase in the number, until, if 4000 white corpuscles are present in a typical case apart from any temporary leucocyte-increasing complication, the prognosis is fairly good. In cases which recover, the most favourable signs are steady gain in body weight, which may occur in spite of persistent low intermittent fever, and a rise of the leucocytes towards or above the normal

number. Once a patient, who has been much emaciated, becomes fat in the face, recovery is practically assured, however large the spleen may still be, although this also subsides greatly in time and often disappears beneath the ribs. Recovery is permanent in spite of continued residence in the endemic area, as proved by the scores of coolies working for years on tea gardens in Assam after recovery from advanced kala-azar. Although cancrum oris and other septic infections and pneumonia are very deadly if, as is usually the case, they produce no marked and lasting increase of the leucocytes, yet in the few cases in which the leucocytes rise to or above the normal in such conditions, early and permanent recovery not rarely ensues. Some recoveries have been reported following leucocyte-increasing measures, especially injections of staphylococcus vaccines or of turpentine.

The discovery of the specific action of intravenous injections of antimony salts has altered the prognosis of kala-azar from one of the worst to one of the most favourable of serious specific diseases. In Mediterranean infantile kala-azar Di Cristina and Caronia first reported 8 cases with 5 cures, 2 recovering, and 1 died; Longo later reported 17 cured out of 20 thoroughly treated cases, while, if insufficiently-treated cases are included, his mortality was 41 per cent against a former death-rate of 90 to 96 per cent.

In the Indian form of kala-azar Rogers independently reported the success of tartar emetic, and has recorded 35 cases in Europeans with 31 cures, 3 greatly improved but left hospital too soon, and 1 died of phthisis after his kala-azar had been cured. He obtained rather better results in Indians with the slightly less toxic sodium antimony tartrate, and still more rapid recoveries with a non-toxic colloid antimony sulphide. In Assam, Dodds Price reported the following results from the use of the sodium salt. Of 50 regularly attending out-patients, 48 were cured and 2 relieved. Of 100 advanced in-patients, 47 were cured, 20 relieved, 18 discharged otherwise, and 14 died. Muir in 183 cases obtained 81 per cent of cures, and the disease has now become rare in the area of Lower Bengal within easy reach of his hospital, showing that in time it may even be stamped out by the present effective treatment, which is also playing an important part in controlling the epidemic disease in Assam, where the case-mortality was formerly 96 per cent.

Leonard Rogers.

KERATITIS, INTERSTITIAL.—(See INTERSTITIAL KERATITIS.)

KIDNEY, INJURIES OF.—(See ABDOMINAL INJURIES; GUNSHOT WOUNDS.)

KIDNEY, MOVABLE.—We have to consider the outlook from the patient's point of view, first, apart from operation, and secondly, when operated on by some of the many methods now in use.

It is well known that the doctor often finds a movable kidney in the course of a routine examination, when there have been no special symptoms connected with it, and it frequently happens that nothing is ever heard about it. On the other hand, severe pain or a wearying sense of drag may make the patient's life a misery.

A number of secondary consequences may appear.

1. *Dietl's Crises.*—These are violent attacks of pain, with hæmaturia, due to kinking of the pedicle. Typical cases are not common.

2. *Intermittent Hydronephrosis.*—A swelling may be felt in the loin, which periodically disappears, and a large quantity of watery urine is passed. This may be due to other causes than kinking of the ureter by a movable kidney.

3. *Secondary Gastric Symptoms.*—It has been maintained that all the symptoms of gastric ulcer (pain, vomiting, hæmatemesis, hyperchlorhydria, etc.) may be induced as a reflex from movable kidney as well as from other abdominal conditions, such as appendicitis and gall-stones. Indeed, the hyperchlorhydria may actually lead to the development of a gastric ulcer. Of 38 cases of movable kidney operated on at the Bristol Royal Infirmary, 5 developed sooner or later a gastric ulcer, one of which perforated fatally. It is by no means certain, however, that the gastric symptoms are always, or even usually a reflex from the kidney. More frequently the kidney shares in a general visceroptosis, associated with a dropped distended cæcum, Lane's ileal kink, Jackson's pericolic membrane, and all the reflex gastric disorders attendant thereon. It is improbable that fixing the kidney would relieve the symptoms. I have seen it tried and fail.

4. *Mental Disturbance*.—According to Suckling, 40 per cent of all women attending a neurological clinic have a movable kidney, and their nervous symptoms are relieved by its fixation, so that he takes it to be causative. The great majority of English surgeons, however, do not think it justifiable to operate unless there is definite evidence of local symptoms referable to the kidney.

The prospects of cure by various forms of pads, belts, and corsets are difficult to estimate. Treves states that nineteen cases out of twenty obtain some relief from Ernst's apparatus, and that it may be left off after two years, but other experience is much less favourable, and the patients frequently declare that the pain is no better, or that the pressure is intolerable.

Results of Operation for Movable Kidney.—The death-rate is not very serious. Edebohls collected records of 846 cases from the literature, with a mortality of 1.65 per cent. Billington has operated on 515 patients, of whom 4 died. At two Bristol hospitals there was 1 death (from sloughing of the wound) in 104 cases. Probably the mortality is about 1 per cent.

Reliable end-results are not easy to obtain, most authors giving very inadequate details, or only following the cases for a few months. Keen mentions 116 patients whose condition was investigated afterwards, but in some cases this was only three months after the operation. He found 58 per cent cured, 13 per cent better, and 20 per cent without relief; but details are lacking.

END-RESULTS OF OPERATION FOR MOVABLE KIDNEY.

Reporter	Cases followed	Cured or nearly cured	Better	No better
		per cent	per cent	per cent
Wilson and Howell	41	49	29	22
Billington	87	60	30	10
Rovsing—				
(a) Uncomplicated	107	85	9	4
(b) Complicated	64	50	25	22
Mills	57	33	10	57
3 London hospitals	83	52	12	36
2 Bristol hospitals	69	58	18	24

Wilson and Howell examined 41 cases who had had various operations at St. Bartholomew's Hospital at least a year previously. Twelve were quite cured and 8 greatly improved; 9 were no better. The acute cases did better than the chronic. In several patients the kidney had broken loose again, but nevertheless there was considerable relief.

Billington has followed up two series of his end-results. In the first, 87 cases were communicated with at least a year after the operation; 60 per cent were almost or quite cured, 20 per cent much better, 10 per cent better, and 10 per cent no better. In a second series, 7 out of 29 patients were reported by their doctors to be no better; the rest were cured or improved. Billington, however, operates on a type of patient that most surgeons would not consider to be sufficiently disabled by the symptoms of movable kidney *per se* to warrant surgical intervention: for instance, neurasthenics and even lunatics. His results are therefore not comparable with those of others. His method of operating is to make a sling out of the capsule of the kidney, combined with Goelet's sutures.

Rovsing, of Copenhagen, reports on a series of cases operated on from one to twelve years previously. Out of these, 107 were cases of uncomplicated movable kidney, whereof 85 per cent were quite cured, 9 per cent better, 4 per cent no better, and 2 died of the operation. In 64 cases complicated by pyelitis, appendicitis, or gastric ulcer, 50 per cent were cured, 25 per cent better, 22 per cent no better, and 3 per cent died of the operation. The method was to make a sling out of the capsule. It is probable that patients with mild symptoms, as most surgeons would judge them, were submitted to operation.

Mills has collected the results of nephropexy at the General Hospital, Birmingham. He investigated 57 cases up to four years afterwards, and found that 33 per cent were

cured, 10 per cent better, 57 per cent no better. In 23 per cent the kidney was again movable. The method of fixation varied. He points out that the patients cured were all characterized before operation by a very significant feature, that the symptoms were relieved when they lay down. Thomson Walker lays stress on the same observation.

At the discussion by the Royal Society of Medicine in 1914, the registrars of three London hospitals presented reports on 83 patients two or more years after operation. Of these, 52 per cent were cured or greatly improved, 12 per cent better, and 36 per cent no better.

The writer has investigated the end-results of 69 operations at two Bristol hospitals under the care of various surgeons. Of these, 40 were cured as far as the kidney trouble was concerned, but some still had indigestion, or pain in the other kidney; 16 were not improved. Several of these were undoubtedly incorrectly diagnosed; one proved afterwards to have a dilated stomach. Many of the failures are due to general visceroptosis and intestinal stasis, with a big, mobile, dropped cæcum. Another suffered from intermittent hydronephrosis. In 6 cases the kidney appears to have broken loose again, but nevertheless 3 of these are much improved. Relapses of pain took place respectively five weeks, six weeks, four months, nine months, a year, and two years after operation. In the last case the kidney slipped during a sudden strain, but the symptoms have almost entirely passed off again. Cases associated with hydronephrosis did not do well.

Although the number of cases is small, some evidence is forthcoming as to the best method of operating. Four procedures are represented:—

1. *Transcortical Suturing*, catgut or silk sutures being passed through the kidney substance and the muscles, or over the last rib. The failures are 5 out of 14, which is a large proportion; 2 kidneys became loose again.

In 18 cases the kidney was sutured to the muscles with catgut, but it is not clear whether the cortex or the capsule was pierced. Of these, 11 were cured, 4 relieved, and 3 no better.

2. *Suture of Capsule*.—In 8 cases the capsule was sutured to the muscles with catgut. Here again the results were poor, and 2 worked loose.

3. *Phenol and Sling*.—The kidney was painted with pure carbolic acid, and an iodoform gauze sling put in beneath the lower pole and left ten to fourteen days. The end-results are quite good, only 3 out of 19 failing. One case (not examined) is said to have relapsed. The writer has seen laceration of the kidney, with hæmorrhage and escape of urine, follow removal of the gauze.

4. *Goelet's Method*.—The capsule is secured by two mattress sutures of silkworm gut passing through the muscles and skin at a higher level. Only ten cases appear, but the results are not so good as the last-named. Billington's method seems very satisfactory.

END-RESULTS AFTER VARIOUS OPERATIONS.

Method	Cases	Cured	Relieved	No better
Suture to muscles	40	22	7	11
Transcortical suture	14	8	1	5
Suture of capsule	8	3	2	3
Phenol and sling	19	12	4	3
Goelet's	10	6	2	2

We may conclude, therefore, that by nephropexy probably 50 per cent will be cured, but one in three or four will not be relieved at all. Better selection of cases will doubtless improve on these results in the future, and, in particular, operation is not advisable unless the pain is relieved by recumbency, and general visceroptosis and stasis should be excluded by barium skiagraphy. The third and fourth methods just mentioned give a higher proportion of cures, namely, about 60 per cent, and only 15 per cent of failures.

REFERENCES.—Billington, *Movable Kidney*, Cassell, 1910; Wilson and Howell, *Movable Kidney*, London, 1908; Rovsing, *Arch. f. klin. Chir.* 1914, 183; Mills and others, *Proc. Roy. Soc. Med. (Surg. Sect.)*, 1914, Feb., 137.

A. Rendle Short.

KIDNEY, NEW GROWTHS OF.—The following factors are important in considering the prognosis of renal new growths :—

1. **The Malignancy of Kidney Growths.**—A small number of benign tumours in the kidney have been described. Some of these, however, are known to develop malignant characters at a later date. The writer has removed a kidney, the seat of extensive malignant growth, from a patient who for five years had passed in the urine portions of papillomatous growth from the renal pelvis which were examined by an eminent pathologist and pronounced non-malignant. Cases of papilloma of the renal pelvis are on record where symptoms had been present for twenty years, and nine and a half years, before operation. The writer also knows of a case where a growth, after removal, was published as an adenoma of the kidney ; the patient afterwards developed multiple bony metastases, from which he died within two years. The number of growths that remain benign must be quite insignificant.

All new growths of the kidney should therefore be looked upon clinically as malignant. Some variation is said to exist in regard to the relative malignancy of the different forms of malignant growths of the kidney, and an opinion based on this might be given after removal and examination of the kidney. Hypernephroma is believed to be less rapid in its course as compared with sarcoma and carcinoma of the kidney. It is, however, unwise to make definite statements based upon the histological varieties. The new growths grouped under the name of hypernephroma show, in some cases, a rapidity of local spread and metastatic deposit that is not exceeded by any of the other forms of renal growth.

2. **The Duration of the Disease.**—Cases are recorded where symptoms had been present for eight (Krönlein), twelve (Israel), and fifteen (Loumeau) years before operation was performed. The average duration of the illness from the commencement of the symptoms to the fatal issue is, however, much less than this. It was three and a quarter years in 32 cases collected by Garceau, and two and a half years in 40 cases collected by Richards, while Keen, Pfahler, and Ellis found an average of two and three-quarter years. The duration of the disease is shortened by the appearance of metastases. When extensive metastases are present in vital organs, such as the lungs or liver, the patient will only survive a few months.

3. **Results of Operation.**—

a. *Immediate Results.*—The operative mortality, including under this head deaths occurring immediately, or any time during the first two months after the operation, has been much reduced during the last decade ; but it still remains high compared with nephrectomy performed for other diseases.

Bloch reports Israel's cases of nephrectomy for malignant growth. There were 124 cases with 28 deaths, an operative mortality of 22·2 per cent. Garceau collected 143 nephrectomies for growth, with 33 deaths, a mortality of 23 per cent. The mortality, however, was under this figure in cases operated in the last ten years. Shock, collapse from hæmorrhage, and cardiac failure were the causes of death. Braasch records a primary death-rate of 11 per cent in the Mayo clinic.

b. *Remote Results.*—The remote results of operation upon kidney growths are to a large extent dependent upon an early date of operation and the thoroughness with which the operation is performed. Certain conditions of the growth facilitate early recognition, or militate against a timely diagnosis.

A tumour situated in the lower pole of the kidney is in a position favourable for an early diagnosis by palpation. Israel recorded a case where a tumour in this position, the size of a nut, was diagnosed. On the other hand, a growth situated in the upper pole is concealed beneath the ribs, and usually reaches a considerable size before it can be detected on palpation. The first change that can be noticed in such cases is a pushing down of the kidney, which is felt lower than normal. The occurrence of hæmaturia is another factor in early diagnosis. It is present in 90 per cent of adult cases. Where it is absent, diagnosis is not likely to be made until a later stage, when the size of the growth attracts attention. The form of hæmaturia is intermittent, and there may be long intervals between the attacks. The significance of this form of hæmaturia is frequently not recognized by those in general practice in this country, the disappearance of the symptom being sometimes regarded as an indication of cure. Until the

practitioner recognizes to the full the importance of hæmaturia as a symptom, and insists upon every case being carefully investigated by cystoscopy, catheterization of the ureters, and, if necessary, by radiography, the time for early diagnosis and favourable operation in a large proportion of cases will pass unheeded, and the prognosis, on this account, will remain very grave.

The operation performed for growths of the kidney should aim at the removal of the perirenal fat and the lymphatics included in the perirenal fascia, which should, if possible, remain unopened, and should be traced to the great vessels.

A collection by Watson and Cunningham of 143 nephrectomies for malignant growth of the kidney showed the following results: Death from operation, 33; death later, after operation, 43; survival, 31; not stated, 36.

The 43 cases that died later, after an operation, were distributed as follows: one year or under, 22; one to two years, 11; two to three years, 6; three to four years, 1; four to five years, 1; seven to eight years, 1; ten to eleven years, 1. Death, these authors note, has occurred from metastases ten years after operation, the patient having enjoyed perfect health in the interval.

The following were the periods of survival after operation in the 31 cases that remained well: one year or under, 9; one to two years, 6; two to three years, 7; three to four years, 2; four to five years, 3; five to six years, 2; six to seven years, 1; nine to ten years, 1.

Bloch describes the late results of Israel's cases of nephrectomy for malignant growth in 124 cases, of which 93 survived the operation; at a two years' limit, 26 remained well and 3 died of accidental diseases; thus, of all the patients who survived the operation 32.6 per cent, and of all the operated cases 27.7 per cent, remained well. At the end of five years, 19 patients were known to be well. This writer remarks that the permanent results of nephrectomy for renal growths are better than those of the operation for stomach and rectal carcinoma, and quite as good as those for mammary carcinoma.

Braasch states that the results in the Mayo clinic showed 10 per cent of cures at the end of five years.

In 20 cases recorded by Rafin, 10 remained well for longer than three years.

4. Age.—The statistics already quoted are for new growths of the kidney in adults. In children, a number of factors combine to make the operation mortality higher, and render the probability of recurrence greater. Hæmaturia occurs in only about 16 per cent of cases, and is rarely present until after an abdominal tumour is discovered. As a result, diagnosis is only made after the growth has assumed considerable dimensions. It follows that the operation is always of a formidable character, while the age of the patient renders him less able to withstand heroic surgical procedures.

Walker puts the general mortality in children from operation and recurrence at 93.22 per cent. Albarran and Imbert give the mortality from operation as 25 to 30 per cent, Simon at 32 per cent, and Lecène as low as 12.44 per cent. Recurrence in patients surviving the operation takes place, according to Albarran and Imbert, in 81 per cent of cases, and Simon states the percentage of recurrences as 67. Recurrence usually takes place rapidly, and appears within the first year. Occasionally it may be delayed, and cases where the growth reappeared three, four, and even five years after are on record.

Simon has collected 11 cases in good health a year or more after operation, among which the longest were—Israel five years, Döderlein four years, Schmidt three years, and Shend and Rovsing each two years. Recently Bastianelli recorded a case well four years after operation. The longest survival of which I have definite information is a case operated upon by Mr. J. D. Malcolm in November, 1892, which was well in February, 1911, eighteen years and three months after operation. Abbe, of New York, recorded two cases of prolonged survival; in one the patient died of new growth of the remaining kidney four and a half years after operation; the other patient was alive and well over ten years after operation. Notwithstanding such results, the prognosis in children is very grave, and some surgeons even advise against operation.

5. Clinical Points in estimating Prognosis.—The important points to take into consideration are the probability of spread beyond the capsule, the formation of metastases, the general condition of the patient, and the condition of the second kidney.

Spread beyond the capsule is indicated when the kidney is fixed, or is very irregular

in outline. Free mobility is a favourable sign, but a large renal growth which is fixed to the liver or diaphragm shows a considerable range of vertical mobility with respiration. A large growth may appear fixed, yet be confined within the capsule of the kidney; but the detection of fixity in a small renal growth is significant of perirenal spread.

Pain, constant or localized, or radiating along nerves, indicates nerve pressure outside the kidney. Renal colic from clot obstruction should be carefully distinguished from this.

The appearance of varicocele on the side of the growth is due to the engorgement of the perirenal veins, but does not necessarily indicate spread of the growth beyond the kidney. It disappears after nephrectomy, and should not be considered a contra-indication to operation. Hochenegg states that if the varicocele does not disappear in the genu-pectoral position, it is due to compression of enlarged glands, and the growth is inoperable.

Metastases are most commonly deposited in the lungs, liver, lymph glands, and bones, and careful examination of these, including radiographic examination, should be made.

Cachexia rarely appears unless the growth is advanced, and has spread beyond the kidney. The cardiac muscle is frequently affected by toxins from the growth, and cardiac failure immediately or some time after operation is not uncommon. Dilatation of the heart, with a feeble, irregular, unequal pulse, is a contra-indication for operation.

As regards the second kidney, the urine should be obtained and examined. A trace of albumin and a few tube casts are frequently present, and they disappear after nephrectomy; but if there are signs of advanced nephritis, and of a reduced renal function, operation is contra-indicated. Bilateral growths are rare. They occur especially in childhood.

J. W. Thomson Walker.

KIDNEY, POLYCYSTIC.—This condition is almost invariably bilateral. Luzzato collected 226 cases, of which only 41 were unilateral; Lejars found only 2 out of 63 cases were unilateral, and Ritchie only 2 out of 72 post-mortems. The disease is invariably fatal, but the duration may extend over many years. Josséraud found that the age at death in 187 cases was as follows:—

Age	Cases	Age	Cases
10-20 years	2	50-60 years	47
20-30 „	13	60-70 „	17
30-40 „	26	70-80 „	11
40-50 „	69	80-90 „	2

Nephrectomy has a very high mortality. Seiber found an operation mortality of 32·7 per cent in 60 cases. Of the 41 cases that survived the operation, only 8 were known to be alive after three years. The longest survivals were 4 after three years, 1 after eight years, 1 after six years, and 2 after seven years.

J. W. Thomson Walker.

KIDNEY, TUBERCULOSIS OF.—Primary tuberculosis of the kidney is said to be present when the kidney is the part of the urinary system first affected. It is obvious, however, that, unlike the lung or bowel, the kidney cannot be directly infected by the tubercle bacillus from without, but must always receive the infection secondarily from some tuberculous focus elsewhere in the body. The nature and activity of this extrarenal tuberculous focus have a considerable influence upon the prognosis.

In the majority of cases of renal tuberculosis that come before the surgeon, either no other tuberculous focus can be found, or, if one exists, it is quiescent or obsolete. In most cases no other lesion can be discovered clinically. Post-mortem evidence goes to show, however, that in such cases the primary focus lies in a tuberculous bronchial or mediastinal lymphatic gland. In other cases there is evidence of old-standing but apparently long-quiescent tuberculous disease of bones, such as Pott's curvature, or old sinuses connected with bones, or there are ankylosed joints, or a foot has been amputated, or a knee excised. In such cases the tuberculosis of the kidney may be considered on its own merits, for the other foci affect hardly at all the future progress of the disease.

In a smaller number of cases there is active tuberculous disease in some other part of the body. A typical example of this is active pulmonary tuberculosis. Here the prognosis is dominated by the pulmonary condition. In such cases the outlook is very

grave, and the patient usually succumbs in about two years, though occasionally after symptoms of only a few months' duration. Less unfavourable cases are those in which the active tuberculosis is in a position where radical treatment is possible, such as the foot, the epididymis, or the cervical glands. When, however, there are found a number of foci of tubercle distributed over the body—as, for instance, where there is renal tuberculosis, bilateral tuberculous epididymitis, tubercle of a joint, and possibly evidence of bygone tubercle of the lung—the resistance is so low that the results of operation are unfavourable, while the outlook under general treatment is very grave. Renal tuberculosis with tuberculous epididymitis is not uncommon, and is not usually so serious. Radical operation may be successful in permanently curing the disease.

In the remarks which follow, renal tuberculosis is considered as primary in the kidney, with no active tuberculous lesions elsewhere, unless specially mentioned.

1. Can Tubercle of the Kidney Heal Spontaneously?—A few observers hold the view that a kidney which has been the seat of tuberculous disease may heal spontaneously; but the great majority of those competent to judge believe that when tuberculous disease attacks a kidney, it is not arrested until the organ is totally destroyed.

In support of the view that spontaneous healing may occur, fibrous scars, some of which show cretaceous deposit, have occasionally been observed. It is not certain that such scars are of tuberculous origin, but even should this be so, the few cases that have been recorded suffice to show that such an outcome is rare. A portion of the kidney affected with tubercle may be shut off from the rest of the organ by occlusion of that segment of the pelvis, and this corresponds clinically to a disappearance of the pus and tubercle bacilli from the urine. After a time, however, another part of the kidney is infected, and symptoms reappear. It is not unusual to find, at operation, that one part of the kidney, corresponding to a division of the pelvis, is distended with tuberculous material, and is isolated by occlusion of the outlet, while more recent active tubercle is seen in the open part of the kidney. Finally, the whole kidney may be distended with fluid or with semi-solid tuberculous material, and the ureter be thick and occluded, so that the entire organ is destroyed and shut off (closed tubercle). The tuberculous disease here is quiescent or obsolete. It may be stated that, short of complete destruction of the organ, tuberculous disease of the kidney does not, with the rarest exceptions, heal spontaneously.

2. Is Tuberculosis of the Kidney Unilateral or Bilateral?—Renal tuberculosis is unilateral in the earlier, and very frequently bilateral in the late, stage. This accounts for some discrepancy between the statistics of different observers. Krönlein states that 92 per cent, Albarran 80 per cent, Brongersma 86 per cent, and Legueu 85 per cent of cases are unilateral, and clinical evidence obtained by catheterization of the ureters, and the results of nephrectomy, certainly support this view. Such statements must always be subject to the qualification that they apply to the early stage. In the late stage the disease, in a large proportion of the cases, is bilateral. Post-mortem statistics given by Gaultier show 57 per cent, by Isermeyer 62 per cent, and by Hallé and Motz 33 per cent bilateral.

Whence does the second kidney derive its infection? Do the bacteria come from the same focus as those that infected the first kidney? Direct evidence on this point is very difficult to obtain, but the results of nephrectomy in unilateral renal tuberculosis show that the second kidney is infected, not from the original primary focus, but from the first kidney. During the first two years after nephrectomy for tuberculous kidney, there is a mortality of 10·6 per cent from tuberculosis of the remaining kidney. The tuberculous disease in the great majority of these cases, if not in all, was present at the time of the nephrectomy. If the mortality due to tuberculosis of the second kidney after surviving two years be examined, it is found to be only 3 per cent. If this figure be compared with the 33 to 62 per cent of infection of the second kidney with tubercle where no operation has been performed, the influence of nephrectomy upon the prevention of tubercle of the second kidney will be realized.

3. The Introduction of Sepsis.—Infection of a tuberculous kidney with pyogenic organisms may result from blood-borne bacteria, but more frequently it is an ascending infection up the ureter from a bladder infected by catheterization. Pyonephrosis very frequently develops, and the patient is dangerously ill. Nephrotomy obviates the urgent

symptoms, and should the second kidney be healthy, nephrectomy can be performed at a later date with a good prospect of success. If the bladder is infected, there is a danger of ascending pyelonephritis of the remaining kidney.

4. Results of Medicinal, Climatic, and Tuberculin Treatment.—*The administration of drugs* has no effect upon the progress of the disease, but symptoms such as pain and bladder irritation can be ameliorated.

A climate which is warm and dry, with an even temperature, moderates some of the more distressing bladder symptoms which accompany renal tuberculosis; but climatic treatment does not permanently influence the progress of the disease.

Tuberculin treatment gives varying results. In some cases of unilateral renal tuberculosis, with or without involvement of the bladder, considerable benefit has resulted from prolonged administration of tuberculin. After one or two years, tubercle bacilli and all signs of inflammation have disappeared from the urine, and there has been no immediate recrudescence of symptoms. Information obtained by the cystoscope and by operation upon such cases shows that the tuberculous focus has become isolated by occlusion of a part of the renal pelvis, or of the entire pelvis, by closure of the ureter. The recrudescence of the tuberculous disease in other parts of the kidney or urinary tract is to be expected in such cases, and it is a mistake to suppose that the temporary disappearance of signs in the urine, and of symptoms, means a permanent cure.

In bilateral renal tuberculosis, tuberculin has a more legitimate field, for curative operation cannot be undertaken. Undoubted improvement takes place in a good proportion of cases under tuberculin treatment, but I have not seen any case of cure.

In cases where there is tuberculosis of one kidney with tuberculous foci in other parts, tuberculin treatment is often of service, either in combination with nephrectomy, or apart from operation. After nephrectomy, tuberculin treatment of genital tuberculosis is likely to be successful.

When tuberculosis of the kidney occurs with active tuberculosis of the lungs, bones, and joints, tuberculin treatment does not give encouraging results. In some cases an improvement in the renal disease takes place; but the extrarenal foci are frequently unaffected, or may even appear to increase under the treatment.

In estimating progress in the treatment of tuberculosis of the kidney by tuberculin, attention should be paid to the increase or decrease of body weight, the general feeling of vigour, the effect on pain, frequency of micturition, tenderness and enlargement of the kidney, and hæmaturia. Where vesical symptoms are present, the amelioration of these frequently provides a striking demonstration of improvement.

The specific gravity and pigmentation of the urine increase as the renal condition improves. The quantity of pus, and the presence and numbers of tubercle bacilli, are critical tests of progress.

5. Immediate Results of Operation.—Nephrectomy in the early stage of renal tuberculosis is the only method by which a cure can be assured, and the operation is indicated whenever the diagnosis of unilateral tuberculosis is made. A preliminary to modern operative treatment of renal tuberculosis is the examination of a specimen of the urine of the second kidney, obtained by catheterization of the ureter. Nephrectomy, as a curative operation, depends upon the absence of the tubercle bacillus and the proof of a satisfactory renal function, as shown by the examination of this specimen. If this is not carried out, the death-rate of nephrectomy reverts to that of the older statistics (25 per cent), and patients who would have lived for some years under palliative treatment, die from anuria after the operation.

Brongersma collected 515 cases operated by various surgeons, with a mortality of 7·18 per cent. He states that when only the statistics of surgeons who use modern methods of diagnosis as a routine measure are taken, the mortality of nephrectomy for unilateral renal tuberculosis falls to 2·85 per cent.

6. Late Results of Operation.—The after-history of 369 patients on whom nephrectomy was performed for primary tuberculosis shows that death occurred after a considerable interval in 56 (15·2 per cent). In these cases the interval varied from one or two to fourteen or sixteen years. In 329 cases of nephrectomy, 35 (10·6 per cent) of the patients died during the first two years; in these cases the fatal result was due to a spread of the tuberculous process.

Of 184 patients surviving two years after nephrectomy for tuberculosis, only 6 (3·2 per cent) died of tuberculosis later.

A series of statistics published in 1911 shows the following figures :—

Surgeon	Cases	Immediate Mortality (within 6 months)	Remote Mortality (up to 2 years)
Israel	{ 1023 (collected) 170 (personal)	12·9 per cent	10 to 15 per cent
Wildbolz	139	2·8 "	15·0 "
Asakura	70	5·7 "	{ 7·1 " (up to four years)
André	57	3·5 "	15·0 per cent
Von Frisch	100	10·0 "	9·0 "

It may be stated, therefore, that there is a risk amounting to 10·6 per cent of the patients dying of tuberculosis during the first two years, and a risk of 3·2 per cent of a fatal result from tuberculosis after this.

J. W. Thomson Walker.

KIDNEY AND URETER, CALCULUS OF.—In the early stage of calculous disease of the kidney, there is a danger of a small stone becoming impacted in the ureter and causing anuria. In the later phase, sepsis and uræmia are the chief conditions to be feared. The following factors are intimately concerned with these dangers, and are therefore important in estimating the prognosis : (1) *The size and number of calculi* ; (2) *Unilateral and bilateral calculi* ; (3) *Asepsis and infection* ; (4) *Results of operation* ; (5) *Recurrence after removal* ; (6) *Calculous anuria*.

1. The Size and Number of Calculi.—In the early stage a primary calculus of the kidney is single and small, and the kidney is healthy, or nearly so. Slight interstitial and parenchymatous changes, described by Albarran under the name of diathetic nephritis, may be present, but it is probable that if the calculus is removed thus early, no serious permanent damage to the kidney will remain.

At this stage the chief danger is impaction of the calculus in the pelvic outlet, or in the ureter, during an attempt to expel it. When the obstruction is incomplete or recurrent, a hydronephrosis results. When the impaction is sudden, and obstruction complete, there is danger of anuria (calculous anuria) resulting. The prognosis in these conditions is discussed elsewhere.

As the calculus increases in size, pressure upon the kidney substance causes interstitial nephritis and atrophy, until eventually, in the case of a very large calculus, the kidney substance is reduced to a mere shell. The renal function is now carried out entirely by the second kidney, and if this should fail, uræmia follows.

At any period in the history of a renal calculus, but especially when the stone becomes larger, or there are a number of calculi present, there is a risk of infection being super-added. The infection usually occurs spontaneously, and the path by which it arrives is the blood-stream (hæmatogenous infection). Occasionally it follows septic catheterization and washing out the bladder (ascending infection). The influence of this complication on the prognosis will be discussed later. Removal of a calculus in the early, small, aseptic stage can be performed without great destruction of renal tissue, and will prevent this complication.

The use of the *x* rays in diseases of the urinary organs has been the means of greatly improving the prognosis in calculus of the kidney and ureter. In the early stage a small stone will throw a shadow on the *x*-ray plate, and its exact position is demonstrated. It is thus possible to operate with certainty, and to extract the calculus with a minimum amount of destruction of kidney tissue. When multiple calculi are present, their number and position are accurately shown on the plate, and each shadow is accounted for at the operation by a corresponding stone. The danger of overlooking a small calculus is thereby greatly reduced. By means of the *x*-ray plate, the operative measures required can usually be planned beforehand. Thoroughness and rapidity of operating are thus facilitated.

When the calculus lies in the ureter, it frequently happens that the symptoms afford no guide to the exact position of the impacted stone. In such a case an exploratory operation, which may be of a very formidable character, is avoided by the discovery of a shadow in the line of the ureter on the *x*-ray plate.

From the foregoing it may be stated that a good prognosis is justified when the calculus is single, aseptic, and of small size, although the condition is not without some immediate risk of calculous anuria. The prognosis is much less favourable, and may be very grave, when calculi are large, multiple, and septic.

2. Unilateral and Bilateral Calculi.—When one kidney contains a calculus, the most frequent form of disease that affects the second kidney is the development of a calculus in this side also. In the early stage of calculous disease, bilateral calculi are not very common; but in the late stage, the second kidney is frequently the seat of calculus.

Israel found bilateral calculi in 27 per cent, Grau in 16.6 per cent, Küster in 11.78 per cent, and Morris in 10 per cent of cases operated; while Legueu found calculi in both kidneys in 50 per cent of 76 post-mortem cases. The latter may be taken to represent the late stage of the disease, while the former gives an indication of the frequency of bilateral calculi in the early stage. With the more general use and the development of radiography, the diagnosis of stone in the kidney is being made at an earlier date, and the number of bilateral calculi is likely to be reduced.

The significance of bilateral calculi depends upon the extent of the disease and the presence of sepsis. The development of calculi in the second kidney, when one organ is already affected, is a grave complication. There are cases where small aseptic calculi are formed in each kidney, and passed at intervals. In such cases the kidneys appear to suffer little change, so long as the calculi pass freely along the ureters. The danger of anuria from impaction of a calculus is, however, much greater, the prognosis after operation graver, and the course of the disease shorter than in unilateral calculus.

When one kidney is the seat of a large calculus or of multiple calculi and the second kidney contains a small calculus, when large calculi are present in both kidneys, and when bilateral calculi are infected, the prognosis is very grave. Nephrectomy in any of these conditions is unwise, and a permanent cure after removal of the calculi is unlikely. In very large bilateral calculi it is a question if the patient will not live longer and in greater comfort without operation. In such cases, recurrence of stone after removal is frequent, and at each operation there is very considerable destruction of renal tissue.

The mortality of nephrolithotomy in bilateral calculus is much higher than in unilateral calculus.

In 22 collected cases of calculous disease where fatal anuria followed operation, there were calculi in the second kidney in 12, atrophy and degeneration in 4, the organ was the seat of fatty disease in 2, amyloid disease in 1, hydronephrosis in 2, and interstitial nephritis in 1.

In order that the prognosis may be estimated in any case of renal calculus, a careful examination must be made of the second kidney and ureter by means of the *x* rays; and the condition of the urine, and the activity of the renal function of the second organ, must be ascertained by examination of the urine, and by the use of the tests of the renal function after catheterization of the ureter.

Küster reports 20 cases of operation on bilateral calculi, in 10 of which a good result followed; fistula persisted in 3 cases, and there were 7 deaths from uræmia. Legueu had 8 double operations; of these, 1 died of uræmia, and 7 recovered. Of the 7 survivors, 2 died of uræmia within a year.

3. Asepsis and Infection.—At some period in the history of unoperated calculus, infection occurs. In rare cases, large bilateral calculi develop in both kidneys and run their course till the final anuria, with nothing more than the very mildest infection of the urine occurring. Usually, however, the urine is contaminated with *B. coli communis*, or with a mixed infection. In some cases calculi develop in an already infected kidney. The prognosis in infected calculus is much graver than when the kidney remains aseptic. The mortality of operation is higher, the probability of recurrence is greater, and the destruction of kidney tissue is much more rapid.

Legueu quotes the statistics given in the tables on the following page in regard to stone operations on aseptic and on infected kidneys.

KIDNEY AND URETER, CALCULUS OF

NEPHROLITHOTOMY IN HEALTHY OR SLIGHTLY INFECTED KIDNEYS.

Reporter	Cases	Deaths
Brongersma -	17	0
Nicolich -	18	0
Zuckerkandl -	8	2
Rovsing -	115	7
Kapsammer -	21	2
Israel -	61	9
Küster -	160	15
Legueu -	20	2
Total	420	37 (or 8·8 per cent)

NEPHROLITHOTOMY IN INFECTED KIDNEYS.

Reporter	Cases	Deaths
Schmieden -	211	43
Küster -	251	50
Brongersma -	2	2
Nicolich -	4	3
Legueu -	5	1
Total	473	109 (or 23 per cent)

4. **Results of Operation.**—The results of operation for renal calculus are governed by a number of factors, such as the size and number of the stones, the condition of the second kidney, the presence or absence of sepsis, the operation performed; and, it may be added, the experience and skill of the operator, for a successful operation may demand a high degree of both.

Some of these have already been discussed, while others require no elaboration. It remains to compare the results of the different operations under varying conditions.

The operations performed for renal calculus are (a) nephrolithotomy, (b) pyelolithotomy, and (c) nephrectomy.

a. Nephrolithotomy.—The results of nephrolithotomy are largely influenced by the presence or absence of sepsis previous to the operation. Some authorities, notably Morris, regard as cases of nephrolithotomy only those in which the kidney is healthy and there is no infection. Most surgeons look upon all cases of removal of calculi from the kidney as cases of nephrolithotomy.

The results in cases uncomplicated by sepsis or dilatation show a very low death-rate. Watson collected 135 cases with 3 deaths (2·2 per cent), and Rovsing 115 cases with 7 deaths (6·08 per cent). Other results have already been quoted.

In infected cases the mortality is high, as the results of Schmieden (20·3 per cent) show. After nephrolithotomy the wound usually heals rapidly, even when mild infection has been present. In infected cases a fistula may persist, and this is occasionally due to calculi having been left in the kidney pelvis, or to ureteral obstruction. In Schmieden's cases (infected) a fistula followed the operation in 22·2 per cent, while in Watson's collection (infected and non-infected) there were fistulae in 8 per cent.

b. Pyelolithotomy.—This operation is confined to a small class of cases where there is a small or moderate-sized calculus occupying the renal pelvis or calices, or where the pedicle is comparatively long and the loin not too deep. In Schmieden's statistics there are 54 cases of pyelolithotomy, of which 36 (66·7 per cent) were completely healed. There were 12 (22·2 per cent) recoveries with fistula, and 6 (11·1 per cent) died.

In the writer's experience, the percentage of fistula following nephrolithotomy and pyelolithotomy, given in the statistics quoted, is much too high.

c. Nephrectomy.—Nephrectomy for calculus is, compared with the operations already discussed, a rare operation, and is reserved for cases where uncontrollable hæmorrhage occurs during nephrolithotomy, where the calculi are very numerous and large, and where the kidney is atrophied or destroyed by dilatation or suppuration, or where a malignant growth complicates the calculus.

Secondary nephrectomy may be called for in urinary fistula, recurrence of stone, or prolonged renal suppuration. The conditions under which the operation is performed are, therefore, of a serious nature, and the outlook is very grave.

The following statistics were collected by Watson: primary nephrectomy, 136 cases, 41 deaths (30.1 per cent); secondary nephrectomy, 33 cases, 6 deaths (18.1 per cent).

5. Recurrence after Removal.—The recurrence of calculi in the kidney after an operation for their removal depends upon a number of factors. Incomplete removal of the stone or stones at the operation is a frequent cause. A deep loin with a narrow space between the rib and iliac crest; a large, fleshy kidney with a short, inelastic pedicle; multiple calculi; an inefficient *x*-ray examination; nervousness and inexperience on the part of the operator: these are factors which have an important bearing on the incomplete removal of stones. Occasionally an aseptic, single, hard stone may be chipped in removal, and the tiny fragment form the nucleus of a fresh concretion. This is much more likely to occur where the calculi are multiple and crumbling.

Sepsis is a prolific source of recurrence, phosphatic stones being rapidly re-formed even after complete removal. The repeated formation of oxalate-of-lime stones, and of uric-acid stones, either after expulsion along the ureter and discharge from the bladder, or after operation, is the unfortunate habit of some patients, and the underlying diathetic condition is very difficult, and sometimes impossible, to control.

6. Calculous Anuria.—Calculous anuria results from the impaction of a small stone in the ureter of one kidney, the second kidney being absent, atrophied, or diseased in varying degree. Rarely the ureters of two functional kidneys are simultaneously blocked by calculi. If the anuria is untreated by operation, death occurs in 71 per cent of cases according to Legueu, and in 67 per cent according to Donnadieu. It takes place usually about the tenth or twelfth day, after two or three days of uræmic symptoms. In cases that have recovered, the date of spontaneous relief was the third day in 1, the fifth to the tenth in 10, the thirteenth in 1, the fourteenth in 1, the fifteenth in 1, and later than the fifteenth in 2.

Operation should be performed at the earliest possible moment in all cases of calculous anuria. It has been held that the operation may be delayed until the fifth or sixth day, as uræmic symptoms rarely supervene before that time. This delay could only be justified by a large proportion of spontaneous recoveries, and such does not exist. Death, if it take place, is a result, not of the operation, but of the condition for which the operation was performed.

Huck's statistics show that the mortality rises each day that operation is delayed. Before the fourth day there is a mortality of 25 per cent, before the fifth day of 30.7 per cent, and before the sixth day of 42.1 per cent. The presence of uræmic symptoms does not contra-indicate operation; successful cases of operation under these conditions have been recorded.

Watson collected 205 cases of calculous anuria, and found the following results of treatment:—

Treated without operation, 110; deaths, 80; mortality, 72.7 per cent.

Treated by operation, 95; deaths, 44; mortality, 46.3 per cent.

These results are capable of great improvement if the necessity for early and rapid operation is fully realized.

J. W. Thomson Walker.

KNEE, TUBERCULOUS.—(See ARTHRITIS, TUBERCULOUS.)

KNEE-JOINT, INJURIES OF THE.—Year by year we obtain a more complete knowledge of the many various consequences of an injury to the knee-joint, and we are gradually becoming more accurate in our prognosis and treatment.

Fractures of the patella and long bones are considered elsewhere (*see pp. 195, 207*). We have here to discuss the outlook in the following conditions: (1) *Synovitis and hæmarthrosis*; (2) *Ruptured ligaments*; (3) *Dislocation of the knee or of the patella*; (4) *Recurrent disability (internal derangement of the knee-joint)*; (5) *Perforating wounds*.

1. Synovitis and Hæmarthrosis.—The signs of these conditions are well known; but it is often impossible at first to decide whether the effusion constitutes the whole trouble, or whether there is also some injury to bone, ligaments, or cartilages; and the prognosis depends principally on this very point. In all but the slightest cases a skiagram should be obtained to show any bony lesion, such as a fracture of the patella or of the condyles, separation of the tibial spine, or a foreign body composed of bone and cartilage dislodged from a condyle. Marked lateral mobility with a tender area over the site of rupture points to tearing of the lateral ligaments. Rupture of the ligamentum patellæ is usually obvious, and the patient is powerless to extend the knee. Antero-posterior mobility, either in extreme flexion or extension, is a sign of tearing of the crucial ligaments.

When any evidence is obtained of one or another of these injuries, it is necessary to expect a prolonged disability and perhaps an imperfect final result. Even when no special signs are present beyond the synovitis, it is impossible to promise a complete permanent recovery, because there may be bruising or tearing of a semilunar cartilage.

Apart from this, however, it is usual for a simple synovitis of the knee to be restored to normal in a month in mild cases, and in two to three months in severe cases, providing the treatment is efficient—rest and cold applications or pressure at first, followed by massage and, when the acute signs pass off, exercises and liniments.

If considerable effusion comes on within an hour of the injury, and especially if there is deep ecchymosis of the skin appearing a day or two later, it is probable that the joint contains blood, and this is apt to absorb badly and to leave a permanent stiffness. This result is only too often seen in a hæmophiliac knee.

It must be borne in mind in giving a prognosis that in rare instances tuberculosis, or acute epiphysitis passing into acute necrosis, may follow an injury; but in these, the original mischief is seldom severe enough to cause synovitis.

Again, it is not uncommon in a middle-aged patient for an injury to be followed by permanent weakness, swelling, and aching as a result of osteo-arthritis. Many of these patients have grating in the other knee, and probably there was an early stage of the disease pre-existing. In some of these cases a loose body is exfoliated into the joint.

2. Ruptured Ligaments.—The special signs of these injuries are as follows:—

Ruptured Ligamentum Patellæ.—A gap between the patella and tubercle of the tibia; inability to extend the knee.

Ruptured Lateral Ligaments.—Excessive lateral mobility; tenderness over the torn ligament.

Ruptured Crucial Ligaments.—If complete, antero-posterior mobility with the knee in flexion or extension. If incomplete, persistent inability to flex to a right angle even after synovitis has cleared up.

Any of these signs would lead the surgeon to give a guarded prognosis; recovery will take several months, and there will often be some permanent disability, happily seldom preventing the patient from walking. Several weeks' fixation will be necessary to allow of sound healing.

3. Dislocations.—Partial or complete dislocation of the knee, a rare accident, is necessarily accompanied by tearing of the important ligaments on which the integrity of the joint depends, and it is therefore bound to be many months before restoration to the normal can take place. Usually there is some permanent weakness and limitation of movement, not sufficient to prevent the patient from walking. It is remarkable, however, that the end-result is usually better than in some of the injuries of the joint which look less alarming at first.

Dislocation of the Patella, especially the outward dislocation, is unfortunately liable to relapse, especially in patients with genu valgum, and various methods of operative treatment have been devised for the relief of this condition, but none are very satisfactory. Albee's wedge-graft operation is probably the best. The disability is usually not serious, even if the patella is left unreduced.

4. Internal Derangement of the Knee.—This convenient term includes those cases in which, nearly always as a sequel to some acute or chronic injury in the first place, the joint repeatedly gives way, locks, or suffers from recurrent attacks of pain and synovitis whenever it is wrenched or twisted. Very similar symptoms may be due to one of five conditions, arranged in order of frequency: (a) *A torn, folded, or loose semilunar cartilage*; (b) *A loose body* (bone, cartilage, fibrous tag, old clot); (c) *Nothing obviously wrong*; (d) *Hypertrophied synovial fringes or alar ligaments*; (e) *Hypertrophied subpatellar fat-pad*.

It is sometimes possible to make the diagnosis without opening the joint. A very definite history of locking, with pain, tenderness, and perhaps a depression over the front of the internal semilunar cartilage, suggest that it is at fault; loose bodies can often be felt both by patient and surgeon, and if bony, a skiagram will reveal them.

The prognosis in internal derangement of the knee-joint has to be considered under the headings of *non-operative* and *operative*.

It is agreed that many cases, apparently of this disease, can be restored to fair comfort without operation, by massage and rest immediately following the first occurrence of the trouble. Sir William Bennett found it necessary to operate on only 123 out of 500 patients. But it is seldom that the knee can be trusted for football or other violent exercises; also, if two or three recurrences take place, non-operative treatment will scarcely succeed in restoring the joint to normal, though a good form of knee-truss may prevent severe attacks of pain and synovitis.

The end-results after operation have been studied by D'Arcy Power in 89 patients at St. Bartholomew's Hospital. Of these it was found by correspondence that:—

73 had no recurrence of attacks.
50 regarded the knee as good as the other.
77 reported movements perfect.
68 had no change in shape; and
43 found the knee painless, whereas 11 had some aching in wet weather,
and 35 always had pain.

Many were well enough to play football again. The writer has investigated the after-history of 40 cases operated on at the Bristol Royal Infirmary. In all of these, at least six months had elapsed since the operation, and in all but 6, at least a year. Of 56 operations, none died, and since rubber gloves were introduced, only 1 case out of 47 suppurated, the patient having taken off his dressings and fingered the wound. He finished with a stiff, swollen knee.

END-RESULTS OF OPERATION FOR INTERNAL DERANGEMENT OF KNEE.

Lesion	No. of cases	Excellent	Good	Fair	Bad
Cartilage torn or very loose -	17	16	1	0	0
Loose bodies -	7	2	2	2	1
Nothing abnormal, or cartilage slightly loose -	8	4	2	1	1
Synovial fringes -	3	1	1	0	1
Notes of lesion inadequate -	5	2	1	1	1
Total -	40	25	7	4	4

It will be observed that when there was a definite lesion of the semilunar cartilages the results are almost uniformly excellent. Six patients are able to play football again, and several are miners; one does his work with comfort after having parted with both his internal semilunar cartilages. In every case the injured cartilage was removed; stitching in place usually leads to recurrence. It had been performed elsewhere in one of our patients, but he had to come to have the cartilage excised.

The cases of loose body, though few could be traced, are decidedly less satisfactory. Apparently a loose body means an osteo-arthritic joint in most cases, which relapses after operation; in one of our series a second loose body was removed two years later.

When nothing abnormal was found, removal of the internal semilunar cartilage nevertheless gave a good result in 6 out of 8 of our cases. In another patient, the after-history suggests that a loose body was overlooked.

Henderson reports the end-results at the Mayo clinic as follows. In 53 cases, the internal semilunar cartilage was removed; of 44 followed up, 30 were cured, 9 relieved, and 5 no better. In these 5, no definite abnormality of the cartilage had been found. In 24 cases, a loose body was removed; of 19 traced, 16 were cured and 3 somewhat better (they had arthritis). In 8, a loose body and the internal semilunar cartilage were removed; they did well.

We may conclude on the whole that the operation for internal derangement is usually followed by the happiest results, except in the loose-body cases and those where no definite lesion is found, where the outlook is not so certainly favourable.

Hypertrophied Subpatellar Fat-pad is due to repeated bruising and nipping between the bones, and produces inability to extend fully, attacks of slight synovitis, and a little fullness beneath the patellar ligament. It will not usually improve until the leg is fixed in slight flexion for a month to allow of recovery. There is no locking, and operation is useless.

5. Perforating Wounds of the Knee.—The vital element in the prognosis after this injury is, of course, the occurrence of suppuration, and its degree. Provided that this can be avoided, the joint will be restored to normal in a few weeks. If suppuration take place, there will probably be one or two months spent in bed, and a permanently stiff knee following, though fortunately it is usually not painful.

In a small proportion of the cases the inflammatory reaction is violent, and the patient suffers a desperate illness, with, it may be, the formation of pyæmic abscesses and occasionally a fatal result. This would nearly always be averted by early and efficient cleansing and drainage. In such bad cases, the knee may ankylose at right angles and remain painful; the writer recollects seeing one patient who, after many operations and narrowly escaping death from pyæmia, finally had to suffer amputation.

(For GUNSHOT WOUNDS, see p. 245).

REFERENCES.—D'Arcy Power, *Brit. Med. Jour.* 1911, i, 61; A. Rendle Short, *Bristol Med.-Chir. Jour.* 1912, 52; Henderson, *Jour. Amer. Med. Assoc.* 1917, Feb. 321. A. Rendle Short.

LACTATIONAL INSANITY.—(See MENTAL DISEASES.)

LARYNX, CARCINOMA OF.—In this disease it is necessary to divide cases into the two following classes: (1) *Intrinsic*, i.e., those arising from the vocal cords true and false, the interarytenoid region, the ventricles, and the subglottic region; (2) *Extrinsic*, i.e., those springing from the upper aperture of the larynx and from the back of the cricoid cartilage.

1. Intrinsic Carcinoma is not very malignant in type. Owing to the arrangement of the lymphatics within the larynx, which do not communicate with those of surrounding parts but empty into a pair of small glands on either side, glandular infection is uncommon, and metastases are so rare as to be practically non-existent.

Growth is often slow, and, in the absence of treatment, cases have been recorded in which life has been prolonged for ten¹ and thirteen² years respectively.

Treatment is essentially surgical, and consists in either intralaryngeal removal through the natural passages, or opening the larynx by thyro-fissure. The former operation is generally condemned, and no statistics are available, although 7 cases of removal with no recurrence for three years are reported by Frankel,³ while in 5 cases operated on by Schmiegelow⁴ recurrence took place in 3.

Removal of intrinsic laryngeal carcinoma by thyro-fissure is probably now the most successful operation in the surgery of malignant disease. Only recent figures must be considered, as, owing to improvements in technique, results have become better of late years.

Thus, in 166 operations, the mortality as a result of operation was 6 per cent. Recurrence took place in 23 per cent; while 64 per cent were free from disease for one year or longer and 47 per cent for over three years.

Semon⁵ has given reasons for considering that if recurrence has not taken place in one year it will not do so.

Thus, the results show an operative mortality of 6 per cent, with cure in either 64 per cent or 47 per cent, compared with figures for amputation of the breast of an operative mortality of 5 per cent and a cure in 42 per cent.⁶

RESULTS OF THYRO-FISSURE IN LARYNGEAL CARCINOMA.

Operator	Number of cases	Died from operation	Well from 1-3 years	Well for over 3 years	Local recurrence
Semon - -	24	1	4	15	3
Chiari - -	29	3	4	11	11
Schmiegelow -	33	5	7	11	10
StClair Thomson -	38	1	12	16	9
Chevalier Jackson -	42	0	2	25	5
Total -	166	10	29	78	38

The exact site of the growth is an important factor in prognosis. The most favourable cases are those in which the tumour projects from and is limited to a vocal cord, while those invading the anterior or posterior commissure or subglottic region are much less favourable.

As a result of this operation, owing to the formation of a cicatricial band to replace the cord which has been removed, the patient is as a rule left with a fair voice. Thus, in 20 cases operated on by Semon, the voice was good in 11, fair in 5, and only a whisper in 4 cases, while Jackson states that in all his cases the voice was fair except where recurrence had taken place.

2. Extrinsic Carcinoma has a very much more serious prognosis. The disease spreads to surrounding parts, glandular infection occurs early, and life is seldom prolonged beyond three years without operation, death usually taking place from aspiration pneumonia.

Operation is the only *treatment* which holds out any hope of cure; a large number of cases, however, do not come under observation until too late a stage.

The operation consists of a partial or complete laryngectomy, frequently accompanied by removal of a portion of the œsophagus or pharynx. The great risk of the operation is aspiration pneumonia, but this risk has been diminished recently owing to the method of shutting off the tracheal opening from the septic pharyngeal discharges.

In all cases, the glands on either side should be removed with the larynx, as recurrence in glands is the most frequent form met with after operation. I have combined together figures for partial and complete removal of the larynx, as, from the point of view of prognosis before operation, one frequently cannot tell how much of the larynx it will be necessary to remove.

PARTIAL OR COMPLETE LARYNGECTOMY.

Reporter	Number of cases	Death from operation	Cure
Koschier - -	13	—	4
Schmiegelow -	9	6	1
Semon - -	5	1	0
Gluck - -	84	5	20*
Jackson - -	8	0	3
Crile - -	24	2	—
Butlin - -	7	1	—
Delavan - -	56	29	—

* Approximate only.

Thus, of 193 cases operated on, the mortality as a result of the operation was 44, or 22·7 per cent, while as a result of operation on 119 cases, a cure was obtained in 28, or 23·5 per cent.

Von Bruns⁷ gives, as a result of figures collected for complete laryngectomy since 1890, an operative mortality of 19 per cent, with a freedom from recurrence of 28 per cent in cases observed less than one year after operation, of 16 per cent from one to three years after, and of 10 per cent over three years after.

Therefore, an operation with a mortality of about one-fifth of the cases gives a prospect of a more or less permanent cure in about a like number.

As a result of this operation, except in a few cases in which only a very partial removal of the larynx has been performed, the patient is speechless. A faint whisper may be developed by using the air in the pharynx, but at the best this is only intelligible to those who are in constant contact with the individual. In addition, especially if the pharynx has been much encroached on by the operation, there may be some considerable difficulty in swallowing.

There is also, owing to the impossibility of an effective cough without a larynx, an increased liability to bronchial and pulmonary affections, and the impossibility of fixing the chest by closing the glottis makes manual labour difficult if not impossible. All these disadvantages may cause a condition of great mental depression.

In considering the advisability of this mutilating operation, however, it must be remembered that the condition of a patient dying of a laryngeal carcinoma is a wretched one. Frequently there is great dyspnoea and dysphagia, and a palliative tracheotomy becomes necessary.

REFERENCES.—¹Gluck, *Jour. Laryngol.* xviii, 484; ²Smith, *Laryngoscope*, 1910, Feb.; ³Frankel-von Bergmann's *System of Surgery*, ii, 241; ⁴*Arch. Laryngol. u. Rhinol.* 1910; ⁵*Jour. Laryngol.* 1903, Sept. 473; ⁶*Ibid.* 1919, May, 148; ⁷*Handbuch der Pract. Chir.* 1907.

A. J. Wright.

LARYNX, PAPILLOMA OF.—This condition usually arises in infancy or childhood. In the absence of treatment the growths may persist for a prolonged period. As a rule, at some time, frequently about puberty, the growths will spontaneously disappear. This does not, however, always take place, and cases have been recorded in which the condition persisted for thirty¹ and thirty-five² years. The alternative *treatments* are:—

1. *Surgical.*—(a) Local removal through the natural passages; (b) Removal by opening the larynx from the exterior; (c) Tracheotomy.

2. *Medical.*—The internal administration of calcined magnesia in large doses.

3. *Radium applications.*

The great risk of the condition is asphyxia, and many of the cases have to be tracheotomized for acute dyspnoea when first seen.

1. *Surgical.*—

a. *Local Removal through the Normal Passages.*—This is the treatment now most commonly adopted, the operation being performed by the direct method, and frequently accompanied by the application of the cautery or caustics to the base of the growths. It will relieve the symptoms for a time, but the growths almost always recur and the operation has to be repeated many times until eventually recurrence ceases. A case has been recorded in which operation was performed 47 times.³ It is almost without risk to life.

b. *Removal by Thyro-fissure.*—This method, formerly much employed, is little used now. It gives no greater security against recurrence than the former method, although a greater risk to life is incurred. It is too serious an operation to be lightly repeated, although a case is recorded in which it was repeated 17 times without a cure.⁴

c. *Tracheotomy.*—In a large number of cases this has to be performed as a matter of urgency. It has also been thought that it will produce a cure by giving rest to the larynx, but it is doubtful if this is so; thus, cases have been recorded in which the growths persisted for fifteen⁵ and thirty-five⁶ years, in spite of this operation.

2. *Medical.*—

Calcined Magnesia.—The administration of this remedy in large doses has been tried. Cures are recorded by Claoné,⁷ Dortu and Masini, a total of 5 cases, all of which had been under treatment by other methods. Rose,⁸ however, reports failure in 2 cases. The method is therefore on its trial.

3. **Radium.**—This has been tried on 2 cases recently by Delavan⁹ and Abbe,¹⁰ with complete success.

Harris¹¹ has collected records of 13 cases treated by himself and others. In all the growths disappeared, but recurrence took place in 3.

Thus radium, if obtainable, would seem to give the best hope of an immediate cure. Calcined magnesia may cure in some cases, and can do no harm. Tracheotomy is often necessary, but will not cure of itself. Local removal is almost without risk, and can be repeated. It is impossible in any given case to say when cure will occur.

REFERENCES.—¹Packard, *Ann. of Otol. Rhinol. and Laryngol.* 1910, Sept.; ²Masini, *Boll. delle Mal. dell' Orecchio*, 1912, March, 49; ³Tilley, *Jour. Laryngol.* xxvii, 218; ⁴Semon, *Proc. Laryngol. Soc. Lond.* 1894, Jan. 1, 62; ⁵Blondian, *Presse Oto-Laryngol. Belge*, 1910, July; ⁶Masini, *Ibid.*; ⁷Claoné, *Ann. des Mal. de l'Oreille, etc.* xxxvi, pt. 1; ⁸Rose, *Jour. Laryngol.* 1913, June, 318; ⁹Delavan, *Ann. of Otol. Rhinol. and Laryngol.* 1910, Sept.; ¹⁰*Ann. of Surg.* 1912, Sept. 470; ¹¹Harris, Internat. Congress of Medicine, 1913.

A. J. Wright.

LARYNX, TUBERCULOSIS OF.—Laryngeal phthisis is for all practical purposes only a complication of pulmonary tuberculosis, and the prognosis is essentially that of the lung condition. The disease usually occurs when the pulmonary condition is advanced, and the prognosis is always grave, the mortality being probably about 90 per cent.

Although the laryngeal and lung conditions usually progress or improve together, not infrequently cases are seen in which the larynx will improve under treatment while the lung gets worse, and the converse. The situation of the disease in the larynx is of importance, those cases in which the epiglottis is involved having the worst prognosis, partly because of the dysphagia and consequent difficulty in taking food, and partly because epiglottic involvement usually occurs when the lungs are extensively diseased. Lake and Barwell¹ give the following figures of the number of deaths taking place while the cases were under observation:—

MORTALITY IN LARYNGEAL TUBERCULOSIS.

Location of disease	Number of cases	Deaths	Proportion
Epiglottis - - -	72	11	1 in 6½
Arytenoids - - -	148	16	1 in 9¼
Vocal cords alone -	35	1	1 in 35

The results of general treatment are those of pulmonary tuberculosis, except that the prognosis is always rendered worse by the presence of laryngeal disease. Sanatorium figures are unreliable in this respect, as the majority of laryngeal cases have pulmonary disease too far advanced for sanatorium treatment. Cases of healing of the larynx under tuberculin are recorded by Wilkinson, Parker, and Blumenfeld,² and the latter gives the number healed by this treatment as about 5 per cent.

The following *treatments* are directed solely to the healing of the laryngeal disease: silence, the use of various pigments and caustics, Pfannenstill's nascent-iodine method, the galvano-cautery, diathermy and *x* rays, removal of disease with punch-forceps and curettes, and major operations such as tracheotomy and laryngectomy.

For the relief of the most distressing symptom, dysphagia, without any idea of cure, amputation of the epiglottis and the blocking or section of the superior laryngeal nerve have been employed.

Silence, in conjunction with sanatorium treatment, has met with some success. Felix Semon³ and Bardswell⁴ have recorded 7 and 6 cases respectively in which healing of the laryngeal condition took place under these conditions.

StClair Thomson⁵ records arrest of the laryngeal disease in 37 out of 178 cases (20·7 per cent) with sanatorium treatment and voice rest, aided in 15 of them by local applications of the galvano-cautery. These were all selected cases.

The use of lactic acid and other pigments is less employed than formerly, and although isolated cases of healing have been described, they are few, and no statistics are available.

Pfannenstill's nascent-iodine method,⁶ in which the patient inspires ozone while taking large doses of iodides, has been employed on only a limited number of cases. The inventor has cured 2 patients on whom he tried the method, and Tidestrom obtained healing in 8 out of 12 cases ; but Stangenberg only found slight improvement in 1 case out of 4 treated, so that the method is at present on its trial.

The galvano-cautery⁷ also produced healing in a number of isolated instances. X rays and diathermy have only been used in experimental cases.

The active local treatment by punches and curettes has been largely employed. Heryng, in the treatment of 252 cases, obtained healing lasting for from one to six years in 20 cases, or 7.8 per cent ; and Barwell, out of 211 cases, obtained healing in 20 per cent, but these cases were only watched for a short period and were not seen after leaving hospital.

Major operations are seldom employed, and the results have usually been disastrous. Gluck gives :—

MAJOR OPERATIONS.

Operation	Number of cases	Healed	Died
Tracheotomy - -	7	1	7
Hemilaryngectomy - -	2	2	0
Laryngectomy - -	20	4	13

Grunwald, of 64 collected cases of laryngostomy, found that only 8 per cent were alive a short time after operation.

Amputation of the epiglottis, in cases in which it is ulcerated and the cause of dysphagia, will usually relieve this symptom, and is an operation without risk to life.

AMPUTATION OF EPIGLOTTIS.

Reporter	Number of cases	Deaths	Relief of dysphagia
Helt - -	24	0	per cent 100
Lockard - -	151	0	84
Moeller - -	25	0	100

The relief of pain by the section of the superior laryngeal nerve, or by injecting alcohol into the nerve in order to block it, has been successfully and largely used recently, and no risk seems to accompany this method. The relief of pain, in the case of alcohol injection, usually lasts about thirty days, and the injection can be repeated.

ALCOHOL INJECTION OF SUPERIOR LARYNGEAL NERVE.

Reporter	Number of cases	Success in
Logan Turner - -	1	1
Fetterold - - -	15	14
Helot - - -	3	3
Bertran and Castillo - -	6	6
Grant - - -	2	2
Total - - -	27	26

Blumenthal has recorded two successful cases of section of the nerve.

Thus, laryngeal tuberculosis is a serious complication of a serious disease. Cases with epiglottic involvement bear the worst prognosis. Cases in which the lung condition remains stationary, or improves, will usually heal with silence and sanatorium treatment. Galvano-cautery and minor operative measures may assist healing. Major operative measures are disastrous. Removal of the epiglottis and blocking of the superior laryngeal nerve give certain relief of dysphagia, without risk, in suitable cases.

REFERENCES.—¹Lake and Barwell, *Laryngeal Phthisis*, 1905; ²*Zeits. f. Laryngol.* iv, 4; ³Semon, *Brit. Med. Jour.* 1906, ii, 1623; ⁴Bardswell, *Ibid.* 1907, i, 1350; ⁵StClair Thomson, *Ibid.* 1914, April 11; ⁶*Hygeia*, 1910, Nos. 5 and 6; ⁷Siebenmann, *Verhandlungen des Vereins deutscher Laryngologen*, 1909.

A. J. Wright.

LATERAL SINUS THROMBOSIS.—(See INTRACRANIAL COMPLICATIONS OF EAR DISEASE.)

LEAD POISONING.—Metallic lead and practically all its salts are poisonous. Even the sulphate and chromate are soluble in the gastric juice, and it has been found that the addition of 1 per cent peptone increases the solubility of the metal and of white lead. Probably the most harmful compound is Pb_2O , while there is only one insoluble and therefore harmless salt, viz., the sulphide. The mechanical as well as the chemical composition of the salt has some bearing on prognosis, for a less soluble salt may be more dangerous than one which is more soluble but less easily powdered. Individual susceptibility is very marked; e.g., one man in a white-lead factory began to have symptoms in two weeks, and died of acute plumbism after five and a half months' work. In the same factory was a man who had worked in white lead for thirty-two years and had felt no ill effects. Probably about a quarter of all workers are not susceptible. There appears also to be a family susceptibility; hence the son of a lead-poisoned father and mother should avoid all work connected with lead. Females are more susceptible than males, especially if they are anæmic. The disease is liable to be very much more severe if there is a constant absorption of small quantities of the poison over a lengthened period than if a large quantity is taken on a single occasion. Further, when lead is absorbed into the respiratory tract by inhalation, the onset of the symptoms is frequently earlier, and they are of a more severe character, than when it is absorbed from the alimentary tract.

In connection with the length of time of exposure necessary before symptoms arise, A. Hamilton, in an analysis of 120 cases, found 1 case of paralysis at the end of one week's work, 1 case of colic at the end of one week's work, 1 case of colic with neuritis after three days; 8 of the workers became ill in less than two weeks, 36 in less than a month, and 89 in less than a year.

Recurrences have a worse prognosis than first attacks. Lead, once absorbed into the system, may remain latent for long periods, and then make itself felt. The symptoms of lead poisoning may therefore develop for the first time after a man has given up all lead work for some months, and in certain cases even a few years have intervened before the manifestation of the symptoms. One attack predisposes to another. It is not possible, however, to assert positively that a patient has entirely recovered from an acute attack, as insidious disease in some of the internal viscera, such as kidneys or liver, may have been initiated.

With reference to the prognosis of lead colic, the outlook is as a rule very good, provided there is no gross organic disease; but if the colic is exceedingly severe, the patient may die during the attack.

Cerebral symptoms are dangerous, especially if the patient becomes comatose. Epileptiform fits may follow each other in rapid succession and prove fatal. If the patient gets over these attacks, recovery may be far from complete, and blindness and aphasia may follow.

The mental condition may also be permanently deranged, or memory be extremely defective; lead may be responsible for a condition closely resembling general paralysis. As a rule, however, the onset is much more rapid, and the prognosis very much better, for very considerable improvement may occur even in the third stage, the gait improving, paralysis diminishing, and the intellectual faculties and speech becoming more clear. Much mental irritation, however, generally persists even in the most favourable cases. Hæmoretinitis may occur with, or apart from, these cerebral symptoms. About 50 per

cent of those who develop this eye trouble get permanent optic atrophy. In the neuromuscular form, the prognosis as to ultimate recovery depends much on the intensity and duration of the paralysis, whether or not there is persistent atrophy, and on the state of the electrical reactions.

Paralysis of the deltoid, biceps, brachialis anticus, and supinator longus occurs in the long-established cases, and hence the prognosis is worse in this form than in the usual forearm type.

In very severe cases paralysis may extend to the muscles of the larynx, the diaphragm, and even the intercostals, and so prove fatal from failure of respiration.

In plumbic pseudo-tabes, recovery is sometimes remarkably rapid, even when inco-ordination, loss of muscle sense, and ataxy have been marked.

The chronic cachectic form undermines the general resistance of the body, rendering it more prone to intercurrent infections. It shortens life by inducing chronic disease of the internal viscera, more especially of the kidneys, arteries, and heart. It also predisposes to gout in all its various manifestations. Lastly, plumbism leads to abortion, with its own dangers.

J. R. Charles.

LEISHMANIASIS.—(See KALA-AZAR.)

LEPROSY.—Leprosy has hitherto been considered an incurable disease, although considerable and sometimes prolonged improvement may take place spontaneously. The majority of cases run a very chronic course of many years' duration, terminating with some intercurrent disease. A few cases, especially of the tubercular type, have an acute course with fever, the patient succumbing to the disease in a few months with extensive lesions in the internal organs. Anæsthetic cases may die from the effects of burns indirectly due to loss of sensation.

In the Sandwich Islands the average duration of life is said to be about ten years (McCoy). An analysis of the figures of the New South Wales leper lazaret from 1883 to 1919 shows 149 admissions, 40 repatriated, 13 discharged but not cured, 24 remaining, and 67 died. Of 118 cases admitted up to the end of 1909, ten years later, at the end of 1919, 51 had been repatriated or discharged, only two of whom had been in for over ten years, 7 remained, and 60 had died; so after excluding the repatriated and discharged cases, the deaths had been 89.5 per cent of those admitted more than ten years previously—a high rate. The duration of the disease on admission was not noted in the report. Only 2 of the fatal cases lived over ten years in the lazaret, and only 11 more lived there beyond five years, while 7 of the 24 remaining cases had resided there for over ten years. The duration of life after the disease is fully developed is therefore not often as long as ten years.

Until comparatively recently leprosy has been regarded as almost incurable, but during the last few years the outlook has considerably improved as the result of new methods of using the old remedy, chaulmoogra oil. The oral use of this drug is only of lasting value in incipient cases, as shown by R. Hopkins' figures for the Louisiana Leper Home for fifteen years regarding 82 cases, with 17 per cent discharged cured and 4 per cent more with lesions disappeared, and definite improvement in most of the rest. In advanced cases, however, none of the 88 were cleared up, and only 26 per cent showed some improvement or arrest of the progress of the disease.

The next advance was the apparent cure of 11.1 per cent of Heiser's typical cases by intramuscular injections of chaulmoogra oil.

Soon after, Rogers commenced the subcutaneous and intravenous injection of a soluble solution of the sodium salts of the unsaturated fatty acids of chaulmoogra (and later of cod-liver) oil, and has reported on 71 cases, with 26 showing lesions disappeared and bacteriologically negative, 32 much improved, 12 improved, and 1 not improved; while of 34 cases followed up for some months the lesions had completely disappeared in 65 per cent.

Muir, Cathew, and others have obtained very similar results. Holman and Dean have also reported good results with a slight modification of Rogers' method by using an ethyl ester, chaulmoograte, intramuscularly. It is still too soon to talk of a cure for leprosy, but even this may now be hoped for.

Leonard Rogers.

LEUCOCYTHÆMIA.—No question with regard to leukæmia can be discussed without some preliminary understanding concerning the terminology employed.

It has been customary to classify cases into the splenomedullary and lymphatic types. It is now recognized that the enlargement of the spleen is a passive process, and consequently the first form is often spoken of as medullary or myelogenous. In recent years there has been a growing tendency to distinguish between ordinary large and small lymphocytes on the one hand, and large and small myeloblasts on the other. These latter can be demonstrated, by special methods, to have a more regular chromatin network and more nucleoli than the lymphocytes, and they are regarded as the precursors of the granular myelocytes, neutrophil, eosinophil, and basophil, which in turn develop into polymorphonuclear leucocytes with the corresponding type of granules.

It is unnecessary for our present purpose to discuss the relationship of these cells, but it is necessary to point out that cases of 'myeloblastic' leukæmia are not infrequently recorded as myelogenous. We are not disposed to quarrel with this, but if such a description leads to the belief that these 'myeloblast' leukæmias are to be classed in the same category as the granular leukæmias as regards symptoms or prognosis, then either the description is unfortunate or the belief is wrong.

We may perhaps best get over the difficulty by classifying the leukæmias in terms of the characters of the preponderating cells as regards the presence or absence of granules. If the cells which are unduly increased are non-granular, it is a matter of little practical importance whether they are to be labelled lymphocytes or myeloblasts.

We thus have to deal with (1) *Lymphatic (non-granular) leukæmia*. This form is usually acute, rarely chronic. (2) *Medullary (granular) leukæmia*. This is usually chronic, very rarely acute. (3) *'Mixed' forms*. (4) *Chloroma*.

1. Lymphatic Leukæmia.—

a. Acute.—An early fatal result is the usual outcome, the only exception being the very occasional transition of a case from the acute to the chronic type of the disease. Some cases end fatally within forty-eight hours of coming under observation; the greatest number die between the fourteenth and thirtieth day; and an intermediate number live for from three to six months. Among the symptoms which indicate an early termination are suddenness of onset and high temperature. Prognosis is usually rather better in those cases showing glandular enlargement as an early symptom than in those where the glands enlarge (if at all) after the diagnosis has been made from the temperature, hæmorrhages, enlarged spleen, and the blood examination.

The early onset of hæmorrhages is a serious symptom. Once a case shows a definite tendency to bleeding, an early fatal termination is practically certain. A single hæmorrhage from the nose or other mucous membrane has not such serious significance, but when bleeding from both nose and gums, hæmatemesis, or hæmaturia has appeared, it is likely to be persistent. Purpura may occur, and a hypodermic injection may lead to the formation of a hæmatoma. Advancing anæmia is another very grave omen. The anæmia is not merely due to the hæmorrhages, but to the unchecked proliferation of lymphocytes in the bone-marrow. The onset of diarrhœa weakens the patient, but in the absence of more serious symptoms it is not of much significance in this form of the disease. Attacks of pneumonia or pleurisy may occur, and may determine an early fatal issue in a case which otherwise might have lasted a few months. Rupture of the spleen is a contingency which has occurred.

Local necroses, ulceration, and the formation of diphtheritic membranes on the gums or cheeks, may lead to a condition of profound toxæmia. Hæmorrhages into the eye or ear may lead to blindness or deafness.

Little significance can be attached to changes in the leucocyte count. It is certain that a falling count is no indication of improvement. A falling lymphocyte percentage would be a favourable omen, but we have never known it take place.

No known form of treatment has any beneficial influence on the course of the acute cases. X-ray application does harm.

b. Chronic.—The spleen is enlarged, and there is also great enlargement of the lymphatic glands. Indeed, the enlargement, especially that of the spleen, may be taken as an index of the previous duration of the case.

The liver also enlarges, and lymphomata may occur in the skin and elsewhere.

The counts in the chronic form are much larger, as a rule, than in the acute, but the actual figures have little relationship to the course of the disease.

A fatal result is sooner or later to be expected. Duration in most cases does not exceed a year, but chronic cases lasting for several, and even for many, years are not unknown. In all our cases of long duration the lymph-glands have apparently been affected early, and it is possible that they belong to a form which commences in the glands and not in the bone-marrow, as is more usually the case. Advancing anæmia, cachexia, intercurrent affection, or the onset of hæmorrhages and acute symptoms, may bring about the end. On the other hand, a few cases undergo remission and may have a precarious existence for a few years. In the remissions the leucocyte count falls, but, as a rule, the lymphocyte percentage remains unduly high. We have, however, notes of one case, that of a miner, age sixty-nine, where a remission appeared to be complete.

The application of x rays or radium in chronic lymphatic leukæmia occasionally does good, and has not the harmful influence it exerts in acute cases. Arsenic appears to do good. We have seen remissions follow the use of naphthalene tetrachloride.

2. Medullary Leukæmia.—Prognosis is absolutely unfavourable. In the usual chronic form, it is difficult to make any statement about duration, on account of the insidious onset. Most cases are likely to live for at least six months after they first come under observation. They probably all die within five years.

The course of the disease is not uniformly downwards, and remissions and relapses are often seen. When remissions occur, the spleen usually diminishes in size and the leucocyte count falls, but the blood-picture generally retains its pathological qualitative features. In some cases, symptoms ameliorate without improvement of any kind in the blood or the size of the spleen. The subject of myelocythæmia is liable to many disabilities. Fatal hæmorrhage has been known to follow such contingencies as an abortion or the extraction of a tooth. Diarrhœa may be a troublesome symptom, and may persist to such an extent as to shorten life. Pressure by enlarged glands on important organs may give rise to serious symptoms. Intercurrent disease may have a remarkable influence on the blood-picture. The leucocyte count may fall to normal as the result of an attack of influenza, and in some cases the count becomes subnormal.

Such complications do not much influence the general course of the disease. The more serious complications of a chronic disease, such as pneumonia and pleurisy, are uncommon in myelocythæmia, possibly on account of the large number of polynuclear cells in the blood.

Myelocythæmia occasionally runs a very acute course. In these cases the duration is from fourteen days to eleven months.

Effect of Treatment.—In the x rays or radium we have a powerful agent for combating the symptoms of myelocythæmia. Their effect is not curative, but the excessive output of leucocytes may be temporarily checked and the circulating excess be destroyed, while the organs are probably freed to some extent from the packing of their substance with white cells, and their functions are for the time being improved, the general health becoming excellent in some cases without further treatment.

The treatment may succeed in establishing remissions on successive occasions, but sooner or later its power fails. In all cases the application must be closely checked by the examination, not only of the leucocytes, but of the red cells also. It is possible to carry on the process of irradiation to such an extent as to exhaust the marrow. It is therefore important not to continue the treatment after the leucocyte count has fallen to 20,000 per c.mm. In many cases toxic symptoms follow the use of x rays. These may be sufficiently alarming, and are most likely to occur in those cases where the spleen diminishes very rapidly in size. We have recently been struck by the advantages of radium over the x rays. This is probably accounted for by the greater penetrative power of radium. In any case it is usually more effective.

The administration of arsenic is another measure which has a beneficial influence on the disease. The patient who is in a position to submit to a combined treatment by x rays or radium and arsenic has a better chance of a moderate prolongation of life than a patient not so favourably circumstanced; the organic preparations of arsenic offer no special advantages. Salvarsan has no good influence on the course of the disease. Some strikingly good results have been recorded as the result of treatment by benzol in capsules.

We have not shared such favourable experience, and consider that the treatment by benzol has more risks, and confers less benefit, than treatment by x rays or radium and arsenic.

Removal of the spleen has been tried in leucocythæmia. The earlier results were disastrous. More recently the procedure has been tried after reduction in the size of the spleen by the application of radium. The operation mortality has been less, but it exerts no good influence on the course of the disease. Incidentally, removal of the spleen robs the practitioner of an important index of the progress of the case, for it is always found that increase in the size of the spleen runs *pari passu* with increase in the circulating leucocytes, febrile attacks which are so common in this disease, and usually, though not always, with anæmia.

3. Mixed Forms.—Mixed leukæmia may arise in two ways:—

a. In lymphatic leukæmia, a considerable number of myelocytes may make their appearance. This is the result of marrow disturbance; the lymphocyte proliferation acts as a stimulus to the parts of the marrow not yet affected. A large number of nucleated red cells generally appear in the blood at the same time. The advent of the myelocytes does not very materially influence prognosis. Any significance which may be attached to their presence is certainly not favourable.

b. In medullary leukæmia, the blood-picture may become mixed by the failure of the marrow to elaborate the granulations in the cells before they pass into the blood. In this way a larger number of lymphocytes (myeloblasts) than usual are present in the films. A high percentage of non-granular leucocytes in a case of myelocythæmia adds to the gravity of the outlook.

4. Chloroma.—This condition may be regarded as leucocythæmia associated with the formation of green-coloured tumours, particularly in connection with periosteum. Prognosis is quite hopeless. In a general way the outlook is the same as in simple leukæmia of corresponding type; but owing to the tumour-formation, the likelihood of pressure-symptoms arising is much greater. There is also a tendency to more rapid emaciation.

G. L. Gulland.
A. Goodall.

LICHEN PLANUS.—It is difficult to lay down any criteria on which to base a prognosis in this disease. Except in a few cases of acute type which develop rapidly and tend to clear up in a few weeks, lichen planus is apt to be progressive, and may last for many months. Its course may be shortened by treatment, and the most important point in the successful management of the severe cases is absolute rest, both mental and bodily.

Chronic patches of the disease are best treated by the x rays, or by radium applied on a flat plate. The affection may run a relapsing course, but when once it has cleared up it shows much less tendency to recurrence than psoriasis. The writer has, however, seen a few cases in which the disease has recurred after intervals of from two to four years.

J. H. Sequeira.

LICHEN SIMPLEX.—This very chronic condition is characterized by oval plaques of lichenized skin at the nape of the neck, elbows, inner side of the thighs, etc., in nervous subjects, attended by intense pruritus. They may last for years unless treated by x rays to relieve the irritation. If the site permits the application of a protective plaster to prevent scratching, the prognosis is good.

J. H. Sequeira.

LINITIS PLASTICA.—(See STOMACH, SURGICAL AFFECTIONS OF.)

LIP, CANCER OF.—As is well known, this is one of the least malignant varieties of epithelioma, but there are cases even of this disease in which the prognosis may be very grave from the first.

Prognosis apart from Operation.—Probably every case would at last prove fatal, but the rate of progress is extraordinarily variable. Sometimes death follows within a few months; in other cases the growth may last for ten years or more. The average duration is about two or three years. Extensive foul ulceration of the lip, face, and jaw takes place, and the glands in the neck enlarge extremely and may suppurate.

Death is usually due to lung troubles. In 34 autopsies, Rowntree found bronchitis, pneumonia, or gangrene of the lung recorded in 29. Metastases in the viscera are uncommon; Rowntree mentions four in the lung, three each in the kidney and liver, and one each in the thyroid, larynx, brain, adrenal, heart, pancreas, and femur. The writer has seen large metastases in the ovaries, more than six years after the original growth in the lip of a woman who smoked a clay pipe.

RESULTS OF OPERATION FOR EPITHELIOMA OF LIPS.

Reporter or Hospital	Operation	Died of operation	Cases followed	Time followed	Cured	Recurred or dead
		per cent		years	per cent	per cent
Wörner, Bruns' klinik (pre 1886) -	896	7	424	3	38	62
Fricke, König's klinik (1874-96) -	114	7	106	3	66*	34
†Bristol Royal Infirmary (1890-1912) -	70	0	—	—	—	—
(a) Lips only removed -	—	—	29	2	69	31
(b) Palpable glands; lips and glands removed -	—	—	11	2	27	73
(c) Lips and glands removed; glands not palpable -	—	—	12	2	83	17
Mayo clinic:						
(a) Lip and glands removed; glands not palpable -	—	—	98	5-8	90†	10
(b) Glands palpable -	—	—	11	5-8	18	82
(c) Lip only operated -	—	—	27	5-8	82	18
Bloodgood:						
(a) Glands not cleared -	—	—	10	5	70	30
(b) Glands cleared—						
1. Microscopically cancerous -	—	—	12	5	50	50
2. Not cancerous -	—	—	21	5	95	5

* In 17 of these, patient followed for less than 3 years. † In 3 of these, patient followed for less than 2 years. ‡ 14 had a second operation.

Mortality of Operation.—The operation death-rate nowadays is very low, even if the glands are removed. None died out of seventy cases operated on at the Bristol Royal Infirmary. Old German statistics give a mortality of 7 per cent, but they go back to pre-antiseptic days.

The Prospect of Cure.—It will be observed that even the methods of pre-antiseptic surgery were able to report about 38 per cent cured, and at a later period the proportion rose to 66 per cent. Out of 52 cases treated by operation and followed up afterwards in the Bristol series, 33 (63 per cent) were well two or more years after. Admittedly, two years is rather early to judge of success; but out of a dozen in whom the neck was cleared although no glands could be felt, 83 per cent were free from recurrence. When lip only was removed, 69 per cent were well. The figures are, however, small.

Sistrunk has reported the figures for the Mayo clinic for the years 1912-13-14; the cases were therefore followed up from five to eight years. In 90 per cent, out of 98 cases, a 'cure' was obtained; in all these the glands were removed. If, however, glands were palpable, only 2 out of 11 were cured. In 27 cases only the lip was operated on; 5 died of recurrence, 3 of other causes, and 19 were alive and well. Bloodgood has followed a series for five years, and finds that clearing the neck improves the prognosis. Where the glands were found to be cancerous, 6 out of 12 were cured; when not cancerous, 20 out of 21.

It is quite clear that when the glands are already palpably enlarged, the outlook is very much graver. Only 3 out of 11 of our cases were alive and well two years after, and in none of these were the enlarged glands proved by the microscope to be cancerous, although the growth on the lip showed as typical epithelioma in section. When the glands show cancer microscopically, both Beckman's and Bloodgood's figures demonstrate that half the cases may be cured. We conclude, then, that if the neck glands are not enlarged, the prospect of cure is probably about 90 per cent if the neck is cleared and a free removal made of the growth in the lip.

Recurrences in the lip are often amenable to treatment, and 3 out of 7 of our Bristol cases did well.

Even if a cure is not effected, the patient is relieved of what might afterwards be a foul growth, unless, of course, it recurs in the lip.

Date and Place of Recurrence.—Of 25 recurrences in the Bristol series, 13 affected the lip (often glands as well), and 12 only the glands. Wider removal, therefore, is still called for. In our cases, recurrence in the neck was usually within six months, but according to Rowntree's statistics the average was seventeen months. This is probably too long. The growth may recur in the lip after a great interval. According to Rowntree's tables, the average is twenty-four months. We had cases three, six, and even twenty-four years after the original operation. Rowntree records one sixteen years after.

In the Bristol statistics, death in the failed cases took place about eighteen months after operation. One survived for three years; another died in five weeks.

REFERENCES.—Rowntree, *Middlesex Hosp. Rep.* 1906, vii, 118; Butlin, *Operative Surgery of Malignant Disease*. 1900, 103; A. Rendle Short, *Brit. Med. Jour.* 1910, ii, 426 (an amplified account is here utilized); Sistrunk, *Ann. of Surg.* 1921, May; Bloodgood, *Surg. Gynecol. and Obst.* 1914, April, 404.

A. Rendle Short.

LIVER ABSCESS, AMŒBIC.—(See AMŒBIC LIVER ABSCESS.)

LIVER, ACUTE YELLOW ATROPHY OF.—Until recently, this disease was regarded as necessarily fatal; indeed the diagnosis was considered to be established only by death or necropsy. It is now recognized that cases presenting the acute symptoms, but not terminating fatally until several months later, show areas of hyperplasia of the liver-cells which compensate for the areas of acute atrophy and thus enable life to be maintained. These cases, called subacute atrophy from their duration, are examples of partial recovery from the disease, and as this compensatory hyperplasia has been seen in cases surviving for months and years, the possibility of permanent recovery cannot be denied; but in the absence of exact confirmation, scepticism as to their nature may be expressed, though a fatal issue would have silenced any doubts. I have seen three such cases. There is still much critical reserve about the acceptance of such conclusions, for though in 1880 Wickham Legg¹ collected twenty-eight reputed cures, F. W. White² in 1908 estimated the recoveries at about the same figure.

In fatal cases of toxic jaundice due to trinitrotoluene (T.N.T.) the liver shows acute yellow atrophy; and a very similar condition of the liver occurs in cases of fatal jaundice after salvarsan treatment of syphilis.

Medical Treatment.—Recovery has been recorded after repeated transfusions of saline solution in a few cases, and the treatment of acid intoxication by transfusion with sodium bicarbonate and enemas containing sugar should improve the outlook. In one case to which I gave horse serum, which has an anti-autolytic action, on the ground that the hepatic change is due to autolysis, recovery followed; but it is obvious that no conclusions can be based on an isolated observation.

Efficient prophylactic treatment in cases which may possibly pass into acute yellow atrophy has some bearing on the prognosis. Thus, jaundice in pregnant women should contra-indicate chloroform anæsthesia in childbirth, and the use of chloral and chloretone, as chloroform causes autolysis of the liver-cells, and should call for the prevention of acidosis and constipation. The benign jaundice which may occur in secondary syphilis readily yields to mercury, and this method of treatment may therefore be regarded as a means of preventing the onset of the rare sequel, acute yellow atrophy. In a certain number of cases, of which Parkes Weber³ has collected fifty-three, acute yellow atrophy supervenes in the course of secondary syphilis, and may thus be compared with acute myelitis in similar circumstances. It is much commoner in women than in men, and may follow the specific jaundice occasionally seen in secondary syphilis. The available observations show that the *Treponema pallidum* is not present in the liver of syphilitic acute atrophy, and the hepatic change therefore appears to be due to poisons manufactured elsewhere and conveyed to the liver. If this is true, mercurial treatment should cut short the supply of poisons and so improve the prognosis, but I cannot bring any figures to substantiate this.

Prognosis in Individual Cases.—Although it be admitted that the disease is not invariably fatal, the outlook in any given case is very gloomy. It is worst in pregnant women. Children, probably from their greater power of repair, show the changes of subacute atrophy more often than adults do, and the prognosis is therefore less grave.

Special Danger Signals.—Rapid diminution of the liver dullness, evidence of grave renal changes as shown by blood-casts and albumin in the urine, acidosis, a hæmorrhagic tendency, the early onset of severe nervous symptoms, coma, and a very high or very low temperature, show that a fatal termination is near.

REFERENCES.—¹Wickham Legg, *Bile, Jaundice, and Bilious Diseases*, 1880, 676; ²F. W. White, *Boston Med. and Surg. Jour.* 1908, clviii, 729; ³F. P. Weber, *Proc. Roy. Soc. Med.* 1909, ii, (*Path. Sect.*), 113.

H. D. Rolleston.

LIVER, CIRRHOSIS OF.—Under this heading the following forms of cirrhosis will be considered: (1) *Portal*; (2) *Biliary*, (a) *hypertrophic*, (b) *obstructive*; and (3) *Syphilitic*.

I. PORTAL CIRRHOSIS.

(*Synonyms*: Multilobular, 'Alcoholic,' Laennec's cirrhosis).

The subject will be treated in the following order: first, some general considerations on the prognosis of the disease, then the prognosis of hæmatemesis, of jaundice, and of ascites and its treatment, then the influence of treatment generally on prognosis, and lastly, the prognosis in individual cases.

The hepatic change is often latent, for in about half the cases in which a cirrhotic liver is found at necropsy, death is due to other causes. The prognosis is thus much better than in biliary cirrhosis. Taking into account the greater frequency of cirrhosis in males, the disease is less often latent in females, possibly because alcoholism when once established is even more difficult to control than in males. In adults, a comparatively early age appears to be favourable as regards greater tendency to improvement, provided alcoholic excess be stopped, probably because the nutrition is better preserved and compensatory processes are more readily effected. Thus the average age of 37 patients in whom temporary or prolonged improvement occurred was thirty-nine years (Cheadle¹), which is about ten years less than the average age of fatal cases of cirrhosis. In children the prognosis is generally considered to be very grave; but from a study of 74 cases of cirrhosis due to alcohol, E. Jones² concludes that "the prognosis is better in children than in adults when the condition is slightly marked, but worse when definite symptoms of hepatic inadequacy have set in".

Hæmatemesis occurs in about one-quarter of the cases, is usually an early symptom, and is directly fatal in only some 5 per cent of the cases dying from the effects of cirrhosis. In Preble's³ 60 collected cases of fatal gastro-intestinal hæmorrhage in cirrhosis, death followed a single hæmorrhage in a third of the cases. As hæmatemesis may induce the patient to alter his habits of life at a comparatively early period of the disease, it is possible that in this way it exerts a favourable influence on the course of the disease. When, as occasionally happens, hæmatemesis occurs late in the disease and in the presence of ascites, the outlook is very gloomy. The occurrence of general hæmorrhages is always a grave sign.

Jaundice, which occurs at some time or another in rather more than a third of all the cases, may be due to several causes, and the prognosis varies accordingly. Often it is transient, and of the form usually spoken of as catarrhal, or it may be slight, without bilirubin in the urine. In these circumstances it does not exert any appreciable influence on the prognosis. On the other hand, the onset of jaundice in the late stages, or when accompanied by fever, multiple hæmorrhages, and nervous symptoms, is a very grave indication; cases of this character may run an acute course, and are more often seen in comparatively young subjects who have been drinking heavily.

Ascites.—The onset of ascites always makes the outlook bad. It is true that ascites may be due to factors associated with cirrhosis, especially chronic peritonitis, and that the prognosis is then not nearly so grave as in ascites due to uncomplicated cirrhosis. But when ascites first appears, it is seldom possible to distinguish between these two conditions, though the presence of œdema of the feet before the onset of ascites is in favour of uncomplicated cirrhosis. As time goes on, a decision can be arrived at on the

ground that frequent tapplings are required in ascites due to chronic peritonitis complicating cirrhosis, whereas in uncomplicated cirrhosis this is not the case. These points are borne out by the following statistics of Ramsbottom⁴: in 31 cases of uncomplicated cirrhosis, the interval between the onset of ascites and death was on an average 188 days, the average number of tapplings two, and the interval between the first tapping and death 46 days; whereas, in 12 cases of cirrhosis associated with chronic peritonitis, the interval between the onset of ascites and death was on an average 394.6 days, the average number of tapplings 6.7, and the interval between the first tapping and death 288 days. For statistical purposes, cases in which the condition of the liver and peritoneum has been examined must be employed, for in those which recover it is obvious that some doubt as to the underlying condition must remain. But recovery certainly occurs after one or more tapplings in patients who appear to have cirrhosis; this has also been confirmed in cases which have proved fatal from other causes, years after the disappearance of ascites.

The Influence of Paracentesis.—Although the prolongation of life after tapping first became necessary was only 46 days in 31 cases of uncomplicated cirrhosis (Ramsbottom), there is no reason to believe that tapping *per se* accelerates the end, for with the present aseptic methods the risk of infection of the peritoneum is practically negligible as compared with the discomfort and bad effects due to pressure on other organs exerted by an unrelieved ascites.

In Individual Cases of Ascites.—The prognosis is rendered gloomy when ascites is preceded by great tympanitic distention, or by œdema of the legs, as these show that there is grave toxæmia; by the occurrence of fever synchronously with the onset of ascites, as this may be due to some complication, such as tuberculosis of the peritoneum or other parts; by concomitant hæmatemesis or melæna; or by such rapid re-accumulation after tapping as to require its repetition in two or three days, as these events may indicate thrombosis of the portal vein.

Surgical Treatment of Ascites of cirrhosis has taken several forms, of which the production of vascular peritoneal adhesions, or the Talma-Morison operation, is the best known. The operation is contra-indicated in an advanced stage of the disease with much toxæmia, by considerable jaundice, and by definite cardiac or renal disease. On the basis of cases observed in Calcutta, Rogers⁵ considers that leucocytosis renders any operation inadvisable. The prognosis is influenced by the stage at which the operation is performed. But it might be urged that cases in the earlier stages are those which might recover if left to nature. From analysis of 227 cases, Sinclair White⁶ estimated that 37 per cent were cured and 13 per cent improved, whereas Willems⁷ concluded that only 4 per cent out of 250 cases were really successful.

Other operations, such as introducing the omentum into a subcutaneous pocket in the abdominal wall (Narath), or establishing permanent drainage of the ascitic fluid into the subcutaneous tissues of the abdomen (Paterson) or thigh through the femoral ring (Wynter and Handley), entail much less operative shock and have been successful in some cases. Possibly the mechanism by which improvement results is on the same lines as in 'autoserotherapy', or the injection of ascitic fluid, after its removal, into the abdominal wall; by injecting 3 drachms every other day, Vitry and Sézary⁸ induced profuse diuresis and cure of the ascites. Of Route's operation, which consists in making an anastomosis between the peritoneal cavity and the internal saphenous vein, Celso⁹ in 1911 collected 10 cases, of which 2 only were successful.

In Egyptian splenomegaly, which, as in Banti's disease, becomes complicated by hepatic cirrhosis, splenectomy, i.e., removal of the supposed focus of the disease, has been employed as a curative measure in the early stages when there is evidence of only moderate hepatic cirrhosis (Richards and Day¹⁰). It is not advisable when ascites or jaundice has appeared. This surgical procedure, therefore, improves the prognosis, but the disease is not ordinary cirrhosis. Splenectomy in 7 cases of cirrhosis in France proved fatal in 2 (Jullien¹¹), and of W. J. Mayo's¹² 9 cases there were 4 "hospital deaths".

The Effect of Treatment is greatly influenced by the period of the disease at which it is undertaken, and thus depends on early diagnosis. Hæmatemesis, the earliest symptom of striking importance, may, under efficient treatment, temperance, and care in diet, be succeeded by years of life, and the underlying cirrhosis may remain permanently latent. But the disease is compensated, not cured, and the compensatory mechanisms

may fail; the hyperplastic areas of liver-cells may degenerate, or the dilated œsophageal veins may rupture and give rise to hæmatemesis.

In Individual Cases.—An advanced stage of the disease, with emaciation, is obviously ominous. Fever points either to a rapidly progressive change in the liver or to the presence of some complication, such as tuberculosis, and is therefore a bad prognostic. The onset of drowsiness is a most grave sign, as showing that lethal coma due to hepatic toxæmia is imminent. The gravity of ascites, œdema of the feet, and multiple hæmorrhages has been referred to already. A good state of nutrition, a positive Wassermann reaction with improvement after antisyphilitic treatment, and satisfactory renal excretion are naturally favourable.

The size of the liver, if taken alone, is not of much value in prognosis, for though an enlarged liver due to compensatory hyperplasia is found in latent cases, enlargement also occurs in cases running an acute course, and may be temporary and due to recent alcoholic excess. The general symptoms must also be taken into account; in the absence of well-marked gastro-intestinal symptoms, a large liver is a favourable sign, and vice versa. Since the spleen is usually large and palpable in progressive and acute cases, and comparatively small in latent cirrhosis, the association of a large liver and spleen is less favourable than a large liver without a palpable spleen.

Occasional glycosuria after indulgence in alcohol or a large amount of sugar has no special bearing on the prognosis. But in the cirrhosis of hæmochromatosis, in which diabetes may result, death usually occurs within a year after the onset of glycosuria. The presence of diacetic acid in the urine, which is rare in ordinary cirrhosis, shows the presence of acidosis, and is therefore ominous. Very well-marked anæmia is a grave sign, and, from his experience in Calcutta, which has not been confirmed for this country, Rogers⁵ considers that a high leucocytosis is a bad sign.

2. BILIARY CIRRHOSIS.

a. Hypertrophic Biliary or Hanot's Cirrhosis is always, or nearly always, fatal. It runs a chronic course with exacerbations, and may last as long as ten or more years; but the average duration is about five years, and acute cases terminating within two years from the onset are sometimes seen. In India, especially in Calcutta, there is a form of endemic cirrhosis clinically somewhat resembling the biliary cirrhosis of Europe, which attacks infants. It is probably different in origin, and is conceivably allied to kala-azar. It runs a more rapid course than ordinary biliary cirrhosis, and it is said that 95 per cent of the cases in Calcutta terminate fatally before the end of the second year of life (Ghose¹³). An endemic form of intercellular cirrhosis characterized by jaundice, fever, ascites, enlargement of the liver but not of the spleen, and by a rapid course in six to eight months, is said to occur in Mexico City (Carmono y Valle¹⁴).

Influence of Treatment.—A quiet life in a healthy sunny place, with protection from cold winds and damp, will prolong life. Calomel has been stated to exert a really beneficial influence on the disease and to cause the jaundice to disappear, but more evidence is necessary before this can be accepted.

Surgical Treatment.—Drainage of the gall-bladder has been stated to give good results; out of 17 cases, 13 were relieved (Greenough¹⁵); but some at any rate of these cases may have been examples of chronic infection of the biliary tract rather than of Hanot's cirrhosis. W. J. Mayo¹⁶ removed the spleen in 5 cases of advanced biliary cirrhosis, with much improvement but not cure.

In Individual Cases.—The patient's general nutrition, inasmuch as it indicates the progress of the malady, naturally influences the prognosis as regards prolongation of life. Clubbing of the fingers is only met with in long-standing cases, and therefore shows that the course of the disease has been slow. Wasting and the recurrence of the febrile exacerbations or crises at shortened intervals indicate that the disease is advancing rapidly. The onset of widespread hæmorrhages and the appearance of ascites and œdema of the legs are very grave indications, and the occurrence of complications such as pneumonia and peritonitis is most serious. Erysipelas, however, may not be fatal, provided the urinary excretion is well maintained.

b. Obstructive Biliary Cirrhosis.—Fibrosis of the liver may be associated with obstruction of the larger bile-ducts. Thus, in congenital obliteration of the bile-ducts,

cirrhosis of the liver is constant ; and in some cases of chronic obstruction of the ducts by gall-stones there is increase of fibrous tissue in the liver. The prognosis of such cirrhosis is largely bound up with that of the associated condition, and cannot be considered independently. Thus, in congenital obliteration of the ducts the outlook is hopeless, and death nearly always occurs before the eighth month of life. In gall-stone obstruction operation may, if the hepatic fibrosis has not become excessive, lead to a cure ; but much enlargement of the liver and the presence of secondary fibrosis add to the gravity of the outlook in gall-stone obstruction and render operation more serious than in cases not so complicated.

3. SYPHILITIC CIRRHOSIS.

In acquired syphilis it is probable that an intercellular cirrhosis, resembling the well-known lesion in the congenital form, occurs ; but opportunities for verifying its presence are very rare. It is possible that it may be a causal factor in the benign jaundice of secondary syphilis, and that when excessive it may lead to acute yellow atrophy—a very rare event (*see* LIVER, ACUTE YELLOW ATROPHY OF). The prognosis of intercellular cirrhosis in adults, assuming that it occurs, is very good as regards the immediate future, for jaundice and acute yellow atrophy very seldom follow. It is, however, reasonable to believe that, if untreated, gummatous change would be more likely to supervene.

Syphilitic Cicatrices.—The deformed and widely-fissured or 'botryoid' liver, due to contraction of gummas and syphilitic cicatrices, is often called 'syphilitic cirrhosis', and no doubt has a superficial resemblance to a coarsely lobulated portal cirrhosis. But it would be more accurately described as syphilitic 'fibrosis' than 'cirrhosis'. It is important to remember that whereas gummas melt away under efficient treatment, cicatrices are not affected ; in the latter condition antisiphilitic measures are disappointing, and in addition misleading, if failure to obtain a good result be regarded as necessarily eliminating the existence of syphilitic change in the liver.

Portal Cirrhosis in the subjects of congenital syphilis, or the occurrence of portal cirrhosis in a liver which, having formerly been affected with intercellular cirrhosis, is left with its resistance so weakened that portal cirrhosis is easily induced, probably explains some cases of portal cirrhosis in early life. The prognosis is much the same as in ordinary cirrhosis in early life. Recently a positive Wassermann reaction was found in 48 per cent of 154 cases of ordinary cirrhosis by Letulle,¹⁷ and in 80 per cent of a series by Symmers,¹⁸ and the question of the syphilitic origin of portal cirrhosis must be faced ; it appears that those cases are more curable than others.

Intercellular Cirrhosis of Congenital Syphilis.—Prompt and efficient antisiphilitic treatment has a most important bearing on the prognosis, not only in curing the condition at the time, but in preventing the occurrence of the delayed congenital lesions such as gummas and amyloid change. Injection of neosalvarsan into the scalp veins is said to be more effective than mercurial treatment, and ante-natal treatment of the pregnant syphilitic mother by neosalvarsan has a markedly good prognostic influence (Findlay and Robertson¹⁹).

In individual cases the outlook depends on the general condition of the patient, and on the degree of enlargement of the liver and spleen, which may be regarded as an index of the severity of the infection. General hæmorrhages and jaundice, which are often due to secondary infection, are very grave signs. Cases with ascites, which is very rare except in infants born with the disease in an advanced stage, are nearly always fatal. The earlier in life the general manifestations of congenital syphilis appear, the graver the outlook.

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H. D. Rolleston.

LIVER, INJURIES OF.—(See ABDOMINAL INJURIES ; GUNSHOT WOUNDS.)

LOCOMOTOR ATAXY.—(See TABES DORSALIS.)

LUNACY.—(See MENTAL DISEASES.)

LUNGS, WOUNDS OF.—(See GUNSHOT WOUNDS.)

LUPUS ERYTHEMATOSUS.—There are two types of this disease: (1) *Acute* and (2) *Chronic*.

1. **Acute.**—In this form the lesions are erythematous, with little or no obvious infiltration. The eruption develops rapidly, involving both flush areas of the cheeks, the root of the nose, the backs of the fingers and hands, sometimes the elbows, knees, and ankles, and, rarely, the trunk. The patients are nearly all young girls or young women. When pyrexia and general symptoms exist, the prognosis is unfavourable, and I have seen several cases end fatally. The mortality is about 15 per cent. The fatal issue may be due to pneumonia, acute nephritis, or pulmonary tuberculosis. In some cases the eruption is hæmorrhagic, and this factor is of grave omen. The prognosis depends mainly upon the general symptoms, and upon the pulmonary and renal condition. In many cases the disease can be controlled, and sometimes cured, by large doses of quinine, preferably given intravenously ; but relapses are common.

2. **Chronic.**—In the more common localized form, the lesions are of limited area, slowly spreading from one or more foci on the cheeks, nose, ears, or scalp, or, rarely, the trunk. The patches are infiltrated, red, and more or less scaly or crusted, with a tendency to produce scars in their centre and to spread peripherally.

Beginning in adolescence or early adult life, the disease has many variations in its activity, and may last for many years. Even when the lesions are quite removed by treatment, or heal spontaneously, it is impossible to promise a permanent cure. The chronic scaly patches are removed temporarily by applications of carbonic-acid snow, by scarification, and by the local application of caustics such as iodine, but recurrence is the rule. These recurrences are more common in the winter months and in the spring. Residence in a warm dry climate prevents relapses, but a return to a humid region is almost invariably followed by a recrudescence of the eruption. Focal infection has been suggested as the cause of the disease ; and attention directed to the general health, and the administration of quinine and tonics, are of service. Many cases gradually improve with lapse of time, but instances in which the disease has been present for twenty or thirty years are not uncommon.

Epithelioma is a rare complication. In two cases which I have seen, it has followed prolonged x-ray treatment.

J. H. Sequeira.

LUPUS VULGARIS.—Extensive lupus of the face is so disfiguring that, while not endangering life, it is a serious drawback to the patient's obtaining a livelihood. It is, therefore, of the utmost importance that the disease be recognized and treated as early as possible. The prognosis depends on : (1) *The presence or absence of disease of the mucous membranes* ; (2) *The extent of the cutaneous affection* ; (3) *The character of the lesions, whether ulcerated or non-ulcerated* ; (4) *The general health of the patient, and the conditions under which he lives, as regards nourishment, hygiene, etc.* ; and (5) *The treatment*.

1. **Involvement of the Mucous Membranes.**—This occurs in 43 per cent of the cases seen at the London Hospital, and the presence of disease in the nasal cavity, on the palate, on the gums or the lips, or in the pharynx or larynx, materially increases the difficulty of treatment, and necessitates a guarded prognosis. It is my experience also that pulmonary affection is more likely to occur in the cases in which the upper air-passages are involved. Where, however, the diseased areas in the nose are within reach, and can be thoroughly destroyed by the curette, cautery, or caustics, or combinations of treatment of this kind, a cure is frequently effected ; but if the surgeon is unable to remove the disease entirely, relapses *in situ*, with secondary involvement of the skin, are the rule. Where the cartilages of the septum and alæ are involved, the outlook as regards permanent cure is less hopeful. The use of nascent iodine (Pfannenstill method) after operation is of great assistance in preventing recurrence in the intranasal cases.

In lupus of the gums, lips, and pharynx, the prognosis depends upon the thorough eradication of all the foci by the cautery, or the application of caustics, such as iodine (1-5).

2. The Extent of the Cutaneous Affection.—The size of the area involved depends, of course, in the main upon the duration of the disease, and therefore upon early diagnosis. Large single areas require prolonged treatment, but if of the dry type the prognosis is not materially influenced. Multiple lesions scattered about the face, limbs, and trunk, such as occur after the acute exanthems, do not yield so readily as the extensive single-focus cases, but many of the foci may heal spontaneously if they are of small size.

3. The Character of the Lesions: Ulcerative or Non-ulcerative.—The dry, non-ulcerative form responds most readily to the Finsen treatment, and the most permanent results, with the least deformity, are obtained in it. X-ray treatment is extremely tedious in this variety, and cure can only be effected at the risk of producing a telangiectatic scar, which may become epitheliomatous. The ulcerative form responds readily to treatment by local antiseptics, followed by exposures to the x rays. Relapses are, however, more common, and there is greater disfigurement.

4. The General Health of the Patient and the Conditions under which he Lives are of great importance. The resistance of the individual to the tuberculous process obviously depends to a large extent upon his general health and upon a sufficiency of good food, fresh air, and proper hygiene. Where these are unsatisfactory, as in the ill-fed children of our large cities, the effects of efficient local treatment are often nullified.

5. The Treatment.—Complete excision of the affected area with a good margin of skin around, and the removal of a sufficiency of the subjacent tissue, give admirable results; grafts may be applied where the area is extensive. Lang, of Vienna, has reported a remarkable series of results. In many cases the operator does not go deeply enough, and, on the face, the fear of increasing the deformity is an ever-present drawback; the result is that patients return with deep-seated nodules which can be seen through the graft. These, I find, are extremely difficult to destroy, except by puncturing with the cautery. Where the lupus occurs in regions in which the character of the scar is of but little moment, the method of excision is to be advised as giving excellent results with the minimum loss of time over treatment.

The Finsen treatment is especially indicated where the lesions are of moderate size, and on the face or exposed parts. The permanency of the results is now assured by a lengthy experience. I have more than 100 cases which have been cured by this method, and which have been free from recurrence for ten to sixteen years. Of 1039 completed cases treated in the Finsen Light department at the London Hospital during thirteen years: 544 were free from recurrence for from three to thirteen years; 186 had been well for less than three years; 117 patients require occasional treatment (they have never been free from recurrence for a long period, but are able to follow their employment); in 161 cases we were only able to report improvement (these patients had usually had extensive disease before treatment was begun, or there had been severe affection of the mucous membranes of the nose, nasopharynx, or buccal cavity); only 31 cases were found to be uninfluenced by treatment.

It should be mentioned that these results were not entirely due to the light treatment, as ulcerated areas received preliminary applications of the x rays, and the nasal, palate, and buccal cases received special treatment, either by operation or the application of strong antiseptics and caustics.

I should like to take this opportunity of protesting against the prolonged treatment of lupus, especially of the dry forms, by the x rays. I have seen a large number of cases in which several hundreds of applications of the rays have been made. The results in some instances have been satisfactory as regards the disappearance of the lupus, though the scar was an ugly one. This, however, is of small moment in comparison with the grave complication of epithelioma. Chronic lupus is followed in about 2 per cent of the cases by epithelioma, but prolonged treatment by the x rays unquestionably increases the liability to cancer, and I regret to say that I have seen cases in which the prolonged radiation has without doubt been the cause of this grave complication.

Treatment of lupus by tuberculin is unsatisfactory. In some cases of the ulcerative type, and in many of scrofuloderma, improvement follows the careful exhibition of this

remedy ; but care is required, for there is no doubt that its uncontrolled administration has been followed by an aggravation of the disease, and also by the stimulation of latent pulmonary foci.

Lupus is not in itself a fatal disease, but in cases in which the nose, pharynx, and larynx are affected there is considerable risk of pulmonary complications ; 6 of my 544 patients cured of lupus died from pulmonary tuberculosis, and 7 others died while under treatment. Tuberculous meningitis also developed in 2 cases while the patients were undergoing the Finsen-light treatment.

J. H. Sequeira.

LYMPHADENITIS, TUBERCULOUS.—We shall confine ourselves in this article to tuberculosis of the glands of the neck. The problems which present themselves are: (1) *The prospects apart from radical removal*; (2) *The mortality of operation*; and (3) *The end-results of cases operated on*.

1. Prospects apart from Radical Removal; or, in other words, the effects of medical and general treatment. Included under this heading are cases in which the bursting of an abscess may be hastened by incision. We have to ask what prospect there is of natural cure, and what is the danger of tuberculosis arising elsewhere. Reliable statistics of a sufficient number of cases are not abundant ; but we may probably accept Wohlgemuth's figures as showing that about 24 per cent are permanently cured. The majority either advance and retrogress alternately ; or remain stationary for many years (the glands often becoming calcareous) ; or, more commonly, softening eventually takes place, and an abscess bursts through the skin, often discharging for a long time, and leaving an ugly scar. In children, the majority of the cases eventually break down ; in adults, the glands have often been present for a long time already, and frequently show no tendency to change further.

Given the best possible conditions, fresh air, good food, etc., the results would no doubt be better. Sea air, especially that of the Kent coast, has a great reputation in this particular complaint. But even under the best circumstances a considerable number of the cases come, or ought to come, to operation.

Tuberculin.—The value of tuberculin is not yet definitely determined by statistics, but it often appears to help. Carmalt-Jones has published a study of 79 cases treated at St. Mary's Hospital inoculation department : he describes 27 as cured, 21 as much better, 18 better, 8 not improved, and 4 worse ; it is not stated how long they were observed. About half had had a previous operation. Patients under ten and over twenty did well ; those between ten and twenty did poorly.

X-ray treatment has recently been advocated as promoting a healing fibrosis.

We may conclude, therefore, that, given the best conditions, about a quarter are likely to be cured apart from operation ; that the majority can be improved for a time, or brought into a comparatively quiescent state ; but that many of these will eventually suppurate ; and further, that tuberculin is probably helpful.

Recurrence Elsewhere.—As to the danger that tuberculosis may develop elsewhere, the figures obtained by Demme from the Children's Hospital at Berne, where cases could be followed up for many years, even as long as twenty, are probably the most reliable we have : of 692 cases treated without operation, 145 eventually developed phthisis, or 21 per cent, and 57 developed tuberculosis elsewhere, or 8 per cent, a total of 29 per cent.

It does not follow, of course, that this was always due to self-infection from the tuberculous glands of the neck.

Prognosis in Individual Cases.—If the glands are already softening, cure will only result by the long and uncertain process of external discharge. The ability to obtain fresh air and good food, and the response to a few months of this treatment, are the principal guides to prognosis.

2. Mortality of Operation.—This must be very small indeed. Of 649 cases at the Mayo clinic, none died of the operation ; the nearest approach was a fatality, four weeks afterwards, from generalized tuberculosis. Dowd had 2 deaths in 465 operations. We may take it, then, that apart from the irreducible minimum of surgical calamities, such as anæsthetic deaths, status lymphaticus, etc., the danger is practically nil.

Nerves may be cut, but it is unusual for section even of such important structures as the vagus or spinal accessory to give rise to any serious permanent trouble ; there may

be some dropping of the shoulder in the latter case. Nor does ligature of the jugular vein appear to do any harm. Cutting the thoracic duct is another harmless bogey.

3. End-results of Operation.—It is difficult to quote figures as to prospects of permanent cure, because operators differ so much in the thoroughness of their methods.

Local Recurrence.—The number of local recurrences is given by different collectors of statistics as follows: Wohlgemuth, 30 per cent; Dowd, 25 per cent out of 100 cases; Judd, 8.6 per cent out of 649 cases in the Mayo clinic; Müller, 13.4 per cent out of 67 cases.

The follow-up system at the New York Hospital shows 100 cases operated on between 1914 and 1918, whereof 22 had to come back for a second operation for return of the lymph-nodes. Of 66 other cases followed up, none were absolutely free from trouble, 48 were regarded as 'satisfactory' (one or two small palpable glands still found, or other small ailments), 16 as 'unsatisfactory', and 2 died at home. These figures are too bad to represent fairly the results of modern hospital practice. Apparently the operations were only on the worst type of case—"the class of cases chosen is usually those in whom operation could not well be avoided; that is, with established or threatened suppuration".

The true recurrence-rate is probably about 1 in 5 or 6, but it would be less if a more complete clearance of glands were made in the first place. Some writers attach great importance to removing enlarged tonsils and carious teeth, as a considerable help in preventing recurrence.

Recurrence Elsewhere.—Another inquiry must be made concerning the prospects of subsequent development of tuberculosis elsewhere after removal of glands from the neck. Von Noorden quotes 149 cases, followed from three to sixteen years after operation, whereof 28 per cent showed evidence of tuberculosis in other organs. Bloss watched 160 cases for three to twelve years; 26 per cent developed phthisis, and 14 per cent tuberculosis elsewhere. Dowd, on the other hand, found only 1 case of tuberculosis of the lung and 3 of bone disease following on 100 operations, but his end-results are not so late as the others. Judd, reporting on 649 cases from the Mayo clinic, found that 19 afterwards died of phthisis and 9 of tuberculosis elsewhere; at the time of operation, only 10 were known to be consumptive. Müller found that 6 out of 67 cases eventually died of tuberculosis.

From these figures we may conclude that removal of the glands is by no means a sure preventive of further tuberculous mischief. It looks, at first sight, as though operation were of no value in averting such mischief, because there is very little difference between the figures quoted for tuberculosis developing elsewhere in the medical and surgical groups. In each group, probably about 1 case in 4 will eventually show signs of phthisis, bone disease, etc.; but it must be remembered, of course, that the non-operated group mostly includes the milder types of the disease, and the operated group the severer types, in which a much larger proportion of cases of dissemination might have been expected, so that it is probable that removal is of some value in preventing recurrence.

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A. Rendle Short.

LYMPHADENOMA (Hodgkin's Disease).—In considering the prognosis of lymphadenoma, it is important to know exactly what is meant by that name. Until 1901–2, when the histological work of Andrewes, Reed, and others definitely established the structural characters of lymphadenoma, cases of lymphatic glandular enlargement which did not fit into any other group, and would now be spoken of as leucosarcoma or lymphosarcoma, were often included; and at an earlier period, confusion occurred with some forms of leukæmia and of tuberculosis. At the present time, microscopic examination of a gland should be regarded as essential to a diagnosis of lymphadenoma, and for strictly accurate statistics only cases, such as Longcope's collection¹ of 86 and Webster's¹² series, in which this has been done, can be accepted. Otherwise, cases of tuberculous large-celled hyperplasia of lymphatic glands or of lymphosarcoma might be thought to be examples of lymphadenoma cured by operation.

True lymphadenoma appears to be invariably fatal sooner or later. The duration of life after the onset of symptoms varies considerably; the rare acute form may run its

course in some weeks or a few months, but usually the disease proves fatal within three years; thus, out of 49 cases followed to their termination, Longcope found that 34, or 69.4 per cent, died within two years, but 2 survived for seven years and another for six years. The question of prognosis is therefore concerned with the duration of life rather than with recovery. Yates and Bunting,² after an experience of 63 cases, conclude that recovery, meaning thereby freedom from signs of recurrence for five years, is possible in 20 per cent of their cases. The usual course of the disease is that the glandular enlargement is at first and for a considerable time local, and with periods of quiescence or remission is slowly progressive, and that eventually it generalizes more or less rapidly and is then accompanied by fever. When the local phase is latent or possibly absent, the disease appears acute from the start.

Medical Treatment.—Arsenic has a marked effect in reducing the size of the glands, and may apparently bring about a long intermission in the course of the disease. Organic compounds of arsenic have also been employed. Salvarsan produces a rapid and striking effect, but it should not be used in debilitated patients late in the course of the disease. Arsenic does not act equally well on all cases of lymphadenoma; sometimes it fails to exert any influence; and although it may be most successful for a time, it may lose its effect and no longer control the glandular enlargement; or in a case in which the glands have become normal after the use of arsenic, a recurrence is quite uninfluenced by that drug. In this connection it is possible that in its progress the disease undergoes some alteration in character, such as transformation into sarcoma (Yamasaki,³ Karsner⁴), or that some secondary infection of the glands has occurred. W. B. Coley¹³ advocates treatment by mixed toxins of erysipelas and *Bacillus prodigiosus* from his experience in 21 cases, particularly in 2 of them in which the lesions entirely disappeared; one of these patients, in whom, however, no microscopic examination of a gland was made, was well seven years later; the other had a recurrence six months later, refused treatment, and died.

X rays prolong life, but do not destroy the unknown cause of the disease; this is shown by the occurrence of relapses. Soft glands containing much cellular elements, and the spleen, diminish in size, but hard fibrous glands are unchanged. According to McNalty,⁵ *x* rays do not influence cases with the relapsing type of fever. In most cases, although striking diminution in size follows *x*-ray treatment, the glandular enlargement recurs when the exposures are discontinued. The application of *x* rays may induce a grave toxæmia and, as shown experimentally, normal lymphoid tissue may be extensively destroyed and grave damage be done. In 42 collected cases Pancoast⁶ found that a 'symptomatic cure' occurred in 18, improvement in 14, and no change or slight improvement only in 10. A further report on 27 of these cases showed that 17 had died of the disease, and that 2 more would shortly succumb; 7 were well three or four years after the first symptomatic cure, and 1 a year after; but 4 of these 8 had had relapses. Thus, a 'cure' for three or four years was obtained in 25 per cent of the cases. From a critical comparison Simmons and Benet⁷ conclude that the improvement under *x* rays is not so great as under radium, which should be brought to bear on all the lymphatic areas in the body, including those in the chest and abdomen, and not limited to the palpable glands, as is the usual practice. Nineteen patients thus treated improved both in their general condition and as regards the glands, the beneficial effect becoming obvious in from one to three weeks after the first application; no case could be considered to be cured, but the patients were comfortable and able to attend to their duties until nearly the end of the disease. The influence of radium and *x* rays on prognosis is better than that of any other form of treatment.

Surgical Treatment is only admissible in the early stage when the disease is localized to a group of superficial glands, as in the neck. From *a priori* considerations it is perfectly logical to remove the primary focus so as to prevent generalization; in some instances this has been thought to delay the course of the disease. In a case under my care there was an interval of five years between operation and death. Recently stress has been laid on the importance of removing the focus of entry, such as the tonsil or carious teeth, by Yates and Bunting,² who also recommend removal of all the accessible diseased tissue by clean mass dissection, and thus report cures of over ten years' duration. On the other hand, it is often impossible to remove all the glands involved when the parts are exposed, and in

some instances recurrence and generalization occur rapidly after operation and after the removal of a gland for diagnosis; the later event, however, is not necessarily due to operation, as it may have begun before the surgical procedure. It is possible that *x*-ray exposures soon after operation might be beneficial by acting on the inoperable glands. Although operation may be desirable to relieve pressure symptoms or to prevent deformity, its influence from a prognostic point of view is probably bad.

Prognosis in Individual Cases.—The prospect of life varies according to the form, stage, and site of the disease. The acute form runs a rapid course and terminates fatally in two or three months; in the common chronic form there are remissions; and there is a latent form in which the glands show little variation in size and few symptoms for years, the disease lasting for eight years; another latent form, in which the deep-seated glands are affected with constitutional symptoms, such as fever and anæmia, has been described. When the disease is confined to a single group of glands, two, three, or even more years may elapse before death, provided pressure is not exerted on some important structure such as the trachea or bronchi.

In the late stage, when generalization has taken place, the end is nearer, but considerable variations are met with. Thus, a mediastinal growth may, by mechanical pressure, precipitate the end. Intrathoracic and intra-abdominal lymphadenoma is more rapidly fatal than widespread superficial glandular implication. This is incidentally shown by the figures given below in connection with the bearing of relapsing fever on the prognosis. Fever of one form or another almost always occurs in the course of the disease, and generally speaking its presence points to an advanced stage with generalization of the disease. The average duration of life after the onset of the relapsing type of fever is about seven and a half months (Batty Shaw⁸), but cases have been known to last more than a year. The cases which present the relapsing form of fever appear to run a more rapid course than others. In 27 cases of lymphadenoma with relapsing fever collected by McNalty,⁵ the extremes of life from the onset of the glandular enlargement were five weeks and four years, and the average 12·7 months; or excluding 3 exceptional cases with durations of two and a half, three, and four years, 9·3 months. In 18 out of these 27 cases in which the superficial glands were enlarged, the average duration was 14·6 months, or excluding the 3 cases of exceptionally long duration, ten months. In 7 cases in which the internal glands only were affected, the duration was eight months.

Hæmorrhages, a grave secondary anæmia, and œdema show that the end is near. Burnham,⁹ who has treated 100 cases in six years, considers that a polymorphonuclear leucocytosis is characteristic of extensive generalization of the disease; and according to Bunting¹⁰ a leucocytosis of about 20,000, a polymorphonuclear count of over 80 per cent, and a lymphocyte count often under 5 per cent, indicate a late stage of the disease. Pruritus, which is rather rare, has appeared to me to be associated with a rapid course of the disease.¹¹

Disappearance of glandular enlargement is not necessarily a good sign, for the disease may advance in the internal organs while the superficial lymphatic glands are disappearing. Further, although the amount of growth left is small, the patient may pass into an extremely anæmic and cachectic condition and die. This may follow prolonged *x*-ray treatment. The appearance of complications, of which tuberculosis is the most frequent, renders the prognosis very grave.

REFERENCES.—¹Longcope, *System of Medicine* (Osler and McCrae), 1915, iv, 755; ²Yates and Bunting, *Jour. Amer. Med. Assoc.* 1917, lxxviii, 747; ³Yamasaki, *Zeits. f. Heilk.* 1904, xxv, 269; ⁴Karsner, *Arch. of Intern. Med.* 1910, vi, 175; ⁵McNalty, *Quart. Jour. Med.* 1911-12, v, 76; ⁶Pancoast, *Univ. Penn. Med. Bull.* 1906-7, xix, 282; ⁷Simmons and Benet, *Boston Med. and Surg. Jour.* 1917, clxxvii, 819; ⁸H. Batty Shaw, *Edin. Med. Jour.* 1901, n.s., x, 501; ⁹Burnham, *Jour. Amer. Med. Assoc.* 1919, lxxii, 220; ¹⁰Bunting, article "Hodgkin's Disease", *Nelson's Loose-leaf Medicine*, New York, 1920, iii, 356; ¹¹Rolleston, *Practitioner*, 1911, lxxxvi, 505; ¹²L. T. Webster, *Johns Hop. Hosp. Rep.*, 1921, xx, 251-314; ¹³W. B. Coley, *Trans. Amer. Surg. Assoc.* 1915, xxxiii, 499.

H. D. Rolleston.

MADURA DISEASE.—This rare disease produces much deformity, and often results in the loss of a foot or hand. It is not a fatal affection, except rarely through secondary septic infection. *X* rays may be of use in its treatment.

Leonard Rogers.

MALARIA.—Malaria is so widely distributed and so commonly prevalent that in spite of a low case mortality it is responsible for a very large total mortality; not so great, however, as stated by some writers, who have assumed that a very large proportion of the deaths returned as due to 'fever' in India are malarial, whereas investigations have shown that even in very malarious parts of Bengal not more than 20 to 25 per cent of 'fever' deaths are due to malaria, a large proportion of which occur in children during the autumnal months at the end of the monsoon. Epidemics of malaria, such as that following exceptionally heavy rain in the Punjab in 1908, cause a high mortality due to heavy infections and lack of adequate treatment.

The case mortality of malaria under efficient quinine treatment is low, having been 2.9 per cent among 210 cases in Europeans in Calcutta, while Daniels records a mortality of 0.91 per cent in more chronic relapsing forms seen at the London docks. In Calcutta the case mortality was twice as high in the malignant as in the benign tertian, while none of the few quartan cases died. The majority of the fatal cases were admitted unconscious and died within a few hours of cerebral malaria, the blood showing extremely numerous parasites. Once unconsciousness has been produced by blocking of the cerebral capillaries by the parasites, recovery is unusual, so it is of the utmost importance to recognize in good time the cases in which this is likely to occur. This can only be done by the microscope, which reveals the danger by showing extremely numerous parasites in the blood, usually of the malignant tertian type. When many parasites are found in every field of an oil-immersion lens the case is a dangerous one, and especially so if the parasites are nearly as numerous as the red corpuscles, when the danger is great and imminent, as the ordinary method of administering quinine by the mouth will fail to save the patient's life. Gaskell and Millar consider that 5000 malignant tertian parasites per c.mm. indicates the danger point. In such cases intravenous or subcutaneous injections of highly-diluted soluble bihydrochloride of quinine are necessary, by which means the mortality has been much reduced in the Panama Canal zone recently. The writer has seen deaths result from the refusal to adopt this treatment in cases in which he had found very numerous parasites present from one to three days before urgent symptoms appeared; while on the other hand a grave case, suspected to be typhoid until the blood was examined, was saved by intravenous quinine, and many similar successes have been reported. The rare intestinal malaria with choleraic symptoms is also very fatal if not detected by the microscope and adequately treated, as in a case with 46 malignant tertian parasites to every 100 red corpuscles, admitted as cholera, and saved by the writer by intravenous quinine treatment.

Apart from the microscope the clinical symptoms are often a very fallacious guide in the prognosis of malaria, except when cerebral symptoms have already set in, when it is usually too late to save the patient. Gaskell attributed fatal cerebral symptoms with few parasites in the blood to hæmorrhages into the white matter of the brain, with very bad prognosis. The height to which the paroxysm rises is of little importance, for temperatures of 106° or more, for a short time, most frequently occur in the relatively innocuous benign tertian form. Of much more importance is the persistence of the remittent type of fever without any fall to the normal line, indicating numerous broods of parasites, producing an approach towards a typhoid-like chart; and the higher the lower limit of the temperature curve, the more severe is the case as a rule, except in the terminal stages, when a low temperature may be seen. In benign tertian cases the failure of the temperature to reach the normal line between the paroxysms indicates an exceptionally severe case. The pulse is always rapid during fever in malaria, but if it is exceptionally high, such as 140 or over, and feeble, it is a bad sign.

Prognosis as regards the prevention of relapses and obtaining a permanent cure is worse in benign tertian than in malignant tertian malaria. Stephens and his co-workers found treatment to be more effective from this point of view in the warm summer months than in the cold winter ones, while Acton found quinidine more active than quinine in benign tertian infections.

Chronic Recurrent Malaria.—Native patients often suffer from repeated attacks of malarial fever through neglect of quinine treatment, when further symptoms occur which affect the prognosis. Severe anæmia and debility, predisposing to dangerous intercurrent diseases such as pneumonia and phthisis, are the most important. Abortion, or

premature delivery of an immature infant which soon succumbs, is a common sequel to chronic malaria, being largely responsible for the high infant mortality and low birth-rate in malarious countries. The size of the spleen is of little guide in the prognosis, as the largest are often seen in the mild quartan malaria, while the organ may be but little enlarged in the severe malignant tertian variety. A normal proportion of leucocytes is a favourable sign in spleen cases, as it indicates an amenable chronic malaria and not the deadly kala-azar. (*See also* BLACKWATER FEVER.) . Leonard Rogers.

MALTA FEVER.—(*See* TROPICAL FEVERS.)

MANIA AND MANIC DEPRESSIVE INSANITY.—(*See* MENTAL DISEASES.)

MASTITIS.—(*See* BREAST, SIMPLE DISEASES OF.)

MEASLES.—The most important points to which attention must be paid in the prognosis of measles are: (1) *The age of the patient*; (2) *The presence of certain complications*; (3) *Certain special symptoms*; (4) *The social status of the patient*; and (5) *The virulence of the epidemic*.

1. **Age.**—It can with confidence be stated in general terms that the younger the patient the worse the prognosis, but that only for patients under two years of age is it really serious. The exact gravity of the prognosis when considered from this point of view varies with the character of the epidemic and the circumstances of the patient. The fullest figures bearing on the subject are those from the city of Aberdeen, where measles was a notifiable disease for the twenty years 1883 to 1902. During that period 40,374 cases were notified, and there were 1346 deaths. For all ages and for the whole period the fatality was thus 3·3 per cent. The following table shows the fatality at different age-periods. From this it is seen that the fatality is considerable, highest in infants under one, and next high in those between one and two. After that age it drops considerably, and remains low at all other ages.

It is possible that the Aberdeen notifications contained a considerable number of cases of rubella. As the latter disease is very rarely fatal, its inclusion in notifications of measles would cause the fatality from this disease to appear to be lower than it really is.

FATALITY ACCORDING TO AGE (ABERDEEN).

Age	Fatality per cent	Age	Fatality per cent
Under 1	13·9	9-10	0·6
1-2	10·0	10-11	0·2
2-3	3·4	11-12	0·0
3-4	1·6	12-13	0·0
4-5	0·9	13-14	1·2
5-6	0·7	14-15	0·0
6-7	0·5	15-25	0·9
7-8	0·5	25-60	0·6
8-9	0·4	60 and over	0·0

The only statistics available in which corrections for errors of diagnosis have been made are those of various hospitals. But inasmuch as the worst cases are, as a rule, sent to hospital, while the less serious are treated at home, the fatality of cases treated in hospitals is usually high. The following table shows the cases admitted into the hospitals of the Metropolitan Asylums Board during the four years 1911 to 1914, with the number of deaths and fatality per cent.

The figures in this table bear out the statement made above as to the diminution of the fatality with the increasing age of the patient. . .

Sex makes no difference in the prognosis.

2. **Complications.**—*Lung Affections.*—By far the most formidable, as well as the most frequent, complication is bronchopneumonia. It accounts for a large majority of the deaths from measles. During the four years 1911 to 1914 there were 1988 cases of

MEASLES

FATALITY ACCORDING TO AGE (METROPOLITAN ASYLUMS BOARD).

Age	Cases	Deaths	Fatality per cent
Under 1	1080	247	22.8
1-2	2728	582	21.3
2-3	2125	251	11.8
3-4	1874	133	7.0
4-5	1470	76	5.1
Under 5	9277	1289	13.8
5-10	2037	56	2.7
10-15	149	3	2.0
15-20	60	0	0.0
20 & over	105	2	1.9
Total	11,628	1350	11.6

measles under treatment at the Eastern Hospital, Homerton, and in 309, or 15.5 per cent, bronchopneumonia supervened. Of the 309 cases, 220, or 71.1 per cent, were fatal. Besides these there were 18 fatal cases of bronchitis. The total number of measles deaths for the three years was 303; so that in 78.5 per cent of the fatal cases death was due to acute bronchitis or bronchopneumonia. These figures suffice to indicate the gravity of pulmonary complications.

Cancrum Oris and *Acute Tuberculosis* are extremely serious, but fortunately they are relatively uncommon. Chronic and latent tuberculous lesions are prone to be stirred into activity by an attack of measles.

Secondary Inflammation of the Fauces should be regarded with apprehension. Not infrequently it results in extensive ulceration and septicæmia.

Implication of the Larynx occurs in between 4 and 5 per cent of the cases. The prognostic significance depends on the period during which it arises. There is less cause for alarm when it occurs during the initial period, before the appearance of the rash, than when it sets in as the latter is fading, or during convalescence. The laryngeal symptoms of the initial period are usually due to simple laryngitis, and in many cases subside when the rash comes out. Late laryngeal symptoms betoken either diphtheria or laryngeal ulceration, both of which conditions are serious, but especially the former. Indeed, hardly a more formidable combination of acute infectious diseases is to be found than that of diphtheria and measles.

But even non-diphtheritic inflammation of the larynx is a very serious complication. During the four years 1911 to 1914 there were 86 cases of laryngitis or ulceration of the larynx at the Eastern Hospital. Of these, 32 were fatal, or 37.2 per cent. In a considerable number of the cases intubation or tracheotomy was necessary. Bronchopneumonia, too, is not uncommon in the laryngeal cases. The incidence of laryngeal complications varies in different years. The 86 cases were distributed amongst the four years, as follows: 1911, 30 cases with 17 deaths; 1912, 28 with 6 deaths; 1913, 20 with 7 deaths; 1914, 8 with 2 deaths.

Eye Affections.—The eye is prone to become inflamed in measles. This complication occurred in nearly 4 per cent of the cases at the Eastern Hospital. Usually the inflammation is limited to the conjunctiva, but occasionally the cornea is involved, in which case an ulcer and an opacity may result. But these sequelæ are rarely seen in cases in which early and assiduous treatment has been applied. One form of ophthalmia is particularly dangerous—namely, that in which not only the conjunctiva, but also the eyelids, are inflamed. There is usually brawny swelling, and the lids are with difficulty separated. These are the cases in which loss of sight results sometimes, even though every attempt is made to save the eye.

Otitis Media occurs in from 11 to 14 per cent of cases treated in hospital. The prognosis is much the same as in scarlet fever.

3. Special Symptoms.—If the respiration becomes hurried and the lips and extremities cyanotic before the rash comes out, the prognosis is grave. When convulsions occur, recovery seldom takes place. Should pulmonary symptoms not clear up within two or three weeks of their onset (which is mostly while the rash is out), tuberculous disease should be suspected. Progressive wasting with pyrexia, with or without diarrhœa, is also suggestive of the same disease. Frequent vomiting and diarrhœa are ominous, especially if they come on early in the disease and are accompanied by a fall of temperature and other signs of collapse.

4. The Social Status of the Patient.—It is a matter of common observation that measles is much more fatal amongst the poor than the well-to-do. Perhaps, indeed, in no other acute infectious disease, with the exception of whooping-cough, is this class-distinction more marked. In Aberdeen it was found, during the twenty years already referred to, that the fatality varied inversely with the number of rooms occupied by the family in which the cases occurred. Thus, in one-roomed houses it was nearly 7 per cent: in two-roomed, 3; in three-roomed, just under 2; and in four- and five-roomed, less than 1. The average fatality for all houses was 2·4 per cent.

5. Virulence of the Epidemic.—The effect of this has also been shown by the Aberdeen figures. In that city the fatality from measles varied from 0 to 25 per cent in different years. The annual fatality per cent of the cases admitted to the hospitals of the Metropolitan Asylums Board has varied from 6·7 to 15·8 during the ten years 1910 to 1919.

E. W. Goodall.

MELANCHOLIA.—(See MENTAL DISEASES.)

MELANOTIC SARCOMA.—The prognosis in this dreaded form of malignant disease has been painted in tones as black as the characteristic nodules of the malady, a view which requires some modification.

Melanotic sarcoma, broadly speaking, arises either in the choroid coat of the eye, or in the skin. In the latter situation it originates either from a congenital pigmented mole, or in rare cases from punctured wounds, which presumably carry a group of the pigmented connective-tissue cells of the skin into a situation favourable to their proliferative activity.

The duration of life in melanotic sarcoma is usually about two to three years. The disease is generally painless until towards the end, but subcutaneous deposits of the disease, when ulcerated, become painful. The patient is usually able to go about and follow his occupation without any feeling of illness until a few months before death. Lymphatic œdema of the affected limb then begins to manifest itself if the disease has begun on one of the extremities, or the deposits in the internal organs—and especially in the liver, which may attain an enormous size—interfere by pressure with the activities of the vital organs, and cause serious effusions which are the usual proximate cause of death. On the whole, melanotic sarcoma is a very merciful form of malignant disease.

As stated in my Hunterian Lectures on melanotic growths, I have obtained strong microscopic evidence that the process of dissemination in malignant melanoma, just as in breast cancer, is primarily one of centrifugal lymphatic permeation. There is, it is true, strong evidence from the results of necropsies that in many cases the blood-vessels are the channels of spread in the later stages of dissemination. The crucial point to settle as determining the prospects of surgical interference in malignant melanoma is this: At what period is lymphatic dissemination supplemented or replaced by blood dissemination? When once viable fragments of the growth are launched into the blood-stream the surgeon's hand is paralyzed, and the patient must depend entirely on the natural forces, always inadequate, and frequently altogether absent, which tend to the destruction of the embolized fragments.

Fortunately it would appear that, as a general rule, blood invasion does not take place at an early stage. This is indicated *prima facie* by the comparatively long average duration of the disease, which has been estimated at three years; if malignant cells reach the blood in the early stage of the disease, the natural powers of resistance must inhibit

their further development, or obviously the patient would succumb within a few months. In the second place, cases of death from intercurrent disease occur, in which lymphatic dissemination sufficiently widespread to be inoperable is seen, unaccompanied by evidence of blood dissemination. Lastly, most extensive lymphatic distribution of the disease may take place in the glands, the subcutaneous tissues, and upon the serous membranes, without any of the nodular visceral metastases which are the usual result of blood embolism. In the museum of Guy's Hospital there is a specimen which bears very directly on this point. It is a kidney, itself entirely free from disease so far as the naked eye can see, but embedded in a mass of melanotic growth which is replacing the perinephric fat. It appears certain that, as frequently happens in breast cancer, the perinephric growth originated from malignant infection of the lumbar glands. If this is the case, it is evident that widespread lymphatic dissemination may occur in melanotic sarcoma, without obvious evidence in the kidneys of embolic blood invasion.

To sum up, pathology indicates that if the operation for melanotic sarcoma is rightly planned, its prospects should not be so hopeless as is generally assumed.

The principles upon which the excision of a malignant melanoma should be carried out are, in my opinion, as follows: A circular incision should be made through the skin round the tumour, at what is judged by present standards to be a safe and practicable distance. The incision, situated as a rule about an inch from the edge of the tumour, should be just deep enough to expose the subcutaneous fat. If necessary, two radial linear incisions extending from the circular one should be made on opposite sides of the tumour in order to facilitate the elevation of the skin flaps, which forms the next step. The skin, with a thin attached layer of subcutaneous fat, is now to be separated from the deeper structures for about two inches in all directions round the skin incision. At the extreme base of the elevated skin flaps a ring incision down to the muscles surrounds and isolates the area of deep fascia and overlying deeper subcutaneous fat to be removed. The fascial area is next to be dissected up centripetally from the muscles beneath, to a line which corresponds with that of the circular skin incision. Finally, the whole mass with the growth at its centre is removed by scooping out with a knife a circular area of the muscle immediately subjacent to the growth. The edges of the wound are to be brought together as convenience dictates.

Writing in 1903, Eve¹ said: "The removal of the nearest chain of lymphatic glands, whether palpably enlarged or not, should never be omitted, for it may be taken as a matter of certainty that in a great majority of cases they are infected". In the same paper, Eve enforces this lesson by recording a case of melanoma of the palm in which, although the axillary glands were not palpably enlarged, they were infected even to the naked eye. Yet Acton,² writing in 1905, found in nearly every case of which the records were available, that the primary growth was removed and the lymphatic glands were left.

Admitting the imperative need for removal of the lymphatic glands as a part of the first operation, it must be remarked that in cases which show palpable enlargement of these glands, simple excision of the glands is likely to be quite useless. I have shown that permeation of the lymphatic plexus of the deep fascia soon takes place around the infected glands, just as it occurs round the primary tumour. The excision of the glands must therefore be carried out on exactly the same principles as the excision of the primary tumour—that is to say, a large circular area of the surrounding deep fascia must be exposed, dissected up from its circumference towards the infected glands, and removed in one piece with them. In late cases it may even be right to remove an area of skin over the infected glands, but such cases are probably inoperable. Lastly—and this is most important—the apparently healthy set of glands above those obviously enlarged should be completely removed.

If the disease originates upon or near the boundary line between two adjoining lymphatic areas, it is important that both sets of glands should be removed. Thus if a growth originates in the middle-line of the thorax, both sets of axillary glands require removal. If the growth starts at the level of the umbilicus, that is to say on the boundary-line between the inguinal and the axillary lymphatic areas, both the inguinal and the axillary glands of the corresponding side must be ablated. For a growth at the umbilicus itself, logic demands that the inguinal and axillary glands on both sides should be excised, though we are here approaching the point where practice of necessity parts company with pathology.

The case which follows illustrates the successful application of these principles.

Miss C., age 40, was sent to me by Dr. Burstal, of Staines, on October 21, 1909. In September, 1907, Dr. Moreton Palmer removed an ulcerated papilloma which had been present on the dorsum of the left wrist for three or four years. In September, 1908, some small lumps were removed just above the epitrochlear gland. These lumps were subcutaneous, and were not glandular. A week or two later, a small dark nodule appeared just below the incision. It was removed under local anæsthesia, and was reported by the Clinical Research Association as a malignant melanoma. Subsequently, the patient suffered much pain in the bicipital region, thought to be due to an involvement of nerves in the scar. On examination, I found a vague induration running up the brachial vessels about the middle of the upper arm, midway between the axilla and the scar of the second operation, and it appeared probable that the growth was recurrent in this situation; moreover, a large gland, nearly as big as a chestnut, could be felt in the axilla. I therefore advised a thorough operation, which should include removal of the supraclavicular glands, clearing of the axilla, and excision of the deep fascia extending from the axilla almost to the elbow. The patient consented to undergo the operation, and was admitted to the Bolingbroke Hospital. A semilunar flap of skin, involving most of the inner aspect of the arm, was turned backwards, and the deep fascia was widely removed, with exposure of the brachial vessels and accompanying nerves. The axilla was next opened by a prolongation into its fornix of the first incision, and was completely cleared of its fat and glands, which were removed in continuity with the deep fascia of the inner side of the arm. The supraclavicular triangle was now cleared of its fat and glands through a separate incision. The patient made a good recovery from the operation.

About a year later, a recurrent nodule appeared over the lower part of the triceps at the back of the arm. It was excised on December 15, 1909, and on section was a typical sarcoma, unpigmented and degenerate at the centre. (It is well known that unpigmented metastases are not rare in melanotic sarcoma.) Since this time the patient has remained well, and the neuralgic pains from which she suffered in the arm have greatly improved, especially since a visit to Sidmouth, where she had hot sea-bathing treatment.

The absence of any sign of recurrence up to the present time, a period of twelve years, encourages me to hope that in this case a permanent cure has been obtained.

In this connection I may repeat what I said in my Hunterian Lectures in 1907: "The methods still employed in dealing with melanotic growths of the skin are precisely those which years ago gave such deplorably bad results in the treatment of carcinoma of the breast. Formerly the tumour, with a small circumferential area of skin, was cut out from the breast, and the axillary glands were removed, if at all, only when palpably enlarged. Even when the glands were excised, the surrounding zone of permeated lymphatics in the breast, in the deep fascia, and in the muscles, was left intact to reproduce the disease. Nowadays, the improved operation for breast cancer produces prolonged or permanent immunity in about 50 per cent of cases. And upon the evidence I have laid before you, I venture to predict that the application of more thorough and scientific methods to the surgery of cutaneous melanomata will produce a corresponding, though perhaps a smaller, improvement in the results of operation."

I trust that the case I have recorded is the beginning of the fulfilment of the prediction then made, though, owing to the fortunate rarity of the disease, the evidence can only accumulate very slowly.

Only one other opportunity has occurred to me of applying the principles which I advocate in the treatment of melanotic sarcoma.

The case was that of a middle-aged man lying in the inoperable cancer wards of the Middlesex Hospital, with a small, non-pigmented, pedunculated growth of the foot, and a mass of confluent and adherent melanotic inguinal glands. I had no sanguine expectation that he would escape local recurrence after the removal of these glands; but since only slightly-enlarged glands could be felt above Poupart's ligament, I thought it worth while to attempt radical treatment. After removing the primary growth, I excised the inguinal glands with a large area of fascia. I then divided Poupart's ligament, and removed the glands along the external iliac vessels nearly as high as the bifurcation of the aorta. But even the highest glands which I could reach already showed signs of early malignant deposit, and it was impossible to carry out the principle which I believe to be so important, namely, the removal of the apparently uninfected set of glands above those enlarged. I was not surprised that this patient returned a few months later with inoperable recurrence in the region of Poupart's ligament.

To sum up, the prognosis in melanotic sarcoma is not nearly so bad as it has been represented, provided that the disease is recognized early, and that it is operated upon on the lines indicated by the pathological evidence of its mode of spread.

REFERENCES.—¹Eve, "A Lecture on Melanoma", *Practitioner*, 1903, Feb.; ²H. W. Acton, *Middlesex Hosp. Jour.* 1905.

W. Sampson Handley.

MENINGITIS.—(See also INTRACRANIAL COMPLICATIONS OF EAR DISEASE.)

Meningococcal Meningitis (sporadic).—In this form, where the diagnosis can generally be clinched by the demonstration in the cerebrospinal fluid of the characteristic diplococcus, the prognosis as to life is relatively more favourable than in other forms of meningitis. Thus, in the 94 cases collected by Lee and Bachow, 50 per cent of the patients admitted to hospital survived; but, of these, only some 15 per cent recovered completely, the remainder being left with hydrocephalus, blindness, or varying degrees of mental deficiency, sometimes amounting to idiocy.

The results of intrathecal injection of antimeningococcal serum are less striking than in the epidemic variety of the disease. Nevertheless, lumbar puncture—by relieving the intracranial pressure—and the administration of the above-mentioned serum, when available, will sometimes turn the balance and may save a patient who would otherwise die.

The prognosis as to the future mental condition of those patients who survive should be guarded. Even after an apparently complete recovery from all the meningeal symptoms, it may be found that the child's subsequent mental development is arrested or delayed. Further, a considerable proportion of cases which survive develop hydrocephalus, probably due to adhesive obstruction in the foramen of Monro or in the other foramina in the neighbourhood of the fourth ventricle, thereby preventing the downward flow of fluid from the ventricles into the spinal theca. Other patients, again, become permanently blind or deaf from inflammatory changes in the optic or auditory nerves.

Meningococcal Meningitis (epidemic).—The prognosis in cases of this type, untreated by serum, is extremely bad. According to the statistics of Flexner, the mortality is usually from 80 to 90 per cent, and never less than 70 per cent. Since the introduction of serum treatment by intrathecal injection, however, the gross mortality of cases thus treated has fallen to a remarkable extent. Thus, out of 1295 serum-treated cases collected by Flexner, 893 recovered and 402 died, a mortality of 31 per cent. The earlier in the disease the specific treatment is begun, the better are the prospects, as shown by the following table of 1211 cases :—

MORTALITY ACCORDING TO TIME OF SERUM TREATMENT.

Period of Disease	Number of Cases	Mortality per cent
Within first three days -	199	18
Fourth to seventh day -	346	27
Later than seventh day -	666	36

The mortality amongst infants under two years of age is usually very high, rarely being less than 90 per cent, according to Flexner. But of 125 serum-treated infants under one year old, 63 recovered and 62 died; of 21 infants injected within the first seven days, 17 recovered and only 4 died, a mortality of less than 20 per cent.

Whereas recovery is a gradual process, lasting about four weeks, in the small proportion of epidemic cases which spontaneously survive, in serum-treated cases, on the other hand, recovery by crisis is not uncommon, and the duration of the disease averages only about eleven days.

Pneumococcal Meningitis, etc.—Pneumococcal meningitis may occur as a primary malady, or it may be secondary to pneumococcal infection of other parts of the body, especially after empyema or otitis media. Untreated cases are practically always fatal. Lumbar puncture undoubtedly relieves symptoms, and may in some cases turn the balance in favour of recovery. The same remark applies to *Streptococcal* and *Staphylococcal*, and also to *Influenzal*, *Typhoidal*, and *Gonococcal Meningitis*. I myself observed a case of gonococcal meningitis in a young man of twenty-nine, in whom, three weeks after the urethral infection, gonococcal arthritis developed in the knee and hand. Three weeks later—that is, six weeks after the original infection—he developed all the signs of meningitis. The cerebrospinal fluid was turbid, with a large deposit of pus.

Anti-gonococcal serum was injected intrathecally, and, on three subsequent occasions within a week, antimeningococcal serum. After a temporary relapse, the patient ultimately made a complete recovery in about three months.

Tuberculous Meningitis.—Here the prognosis is always grave. Once the diagnosis has been established, by the presence of headache, vomiting, convulsions, stupor, by the occurrence of a pleocytosis of the cerebrospinal fluid, and, most conclusive of all, by the discovery of tubercle bacilli in the fluid, we must be very guarded in our prognosis. The prospects of recovery depend upon various factors. If the disease be limited to a small part of the meninges, and if there be no extension into the substance of the brain, there is still a possibility of recovery. If, however, the meningitis be widespread, and accompanied by numerous signs of focal brain affection, the hope of recovery is almost nil. The occurrence of glycosuria is of bad omen; when present, it generally presages death within two or three days.

In making our prognosis in any individual case of meningitis, from whatever cause, we have to bear in mind that the immediate causes of death are two in number: first, mechanical distention of the cerebral ventricles (acute hydrocephalus); and second, toxæmia resulting from the products of the infective organism. The toxæmic element, unfortunately, is not at present directly amenable to treatment; but if this factor be not too intense, we may, by relieving the mechanical distention, sometimes save the patient's life. This is best done by early and repeated lumbar punctures. After withdrawing cerebrospinal fluid until the intrathecal pressure falls to normal, we generally obtain distinct improvement in the clinical symptoms, so that the coma or stupor clears up, temporarily at least, and the headache and vomiting are relieved. By repeated lumbar punctures at intervals of one or two days, life may thus be prolonged, and cure may even result. I may quote a case of my own, a young man of twenty-two, with headache, vomiting, stupor, head retraction, absent knee-jerks, etc., in whom a patch of chronic lupus on one leg gave clinical evidence of tuberculous infection, and in whom the cerebrospinal fluid contained no fewer than 3467 lymphocytes per c.mm. Repeated lumbar punctures, five in all, about once a week, produced not only disappearance of all the clinical symptoms, but the pleocytosis of the cerebrospinal fluid fell successively to 827, 787, 36, and 16 cells per c.mm., and the patient made a perfect recovery. Such cases, it must be admitted, are the exception; but the fact that they do occur must modify the view hitherto almost universally held, that the result must certainly be fatal, once the diagnosis of tuberculous meningitis is established.

Meningism is a condition in which the patient, usually a child, either during the course of some specific fever (especially measles and mumps) or in any febrile condition, develops many of the clinical phenomena of meningitis, but where the cerebrospinal fluid withdrawn by lumbar puncture contains neither excess of cells nor organisms. It is more frequent in children with a tuberculous diathesis, and may thus raise the suspicion of tuberculous meningitis. The symptoms rapidly clear up after the lumbar puncture. After the meningitic symptoms have subsided there is often a stage of transient cerebellar ataxia, which ultimately passes off completely.

J. Purves Stewart.

MENTAL DISEASES.—

[*Prefatory Note to article on Mental Diseases.*—This article has given the Editor a good deal of concern. Sir Thomas Clouston, the distinguished author, is unhappily no longer with us. His monograph was therefore submitted to two front-rank authorities on mental diseases with a view to bringing it up to date. They both report that at the present time the whole subject is in such a state of flux that revision is practically impossible. The trouble is that the article is written to the old classification, and up to the present the material simply does not exist to discuss the prognosis of mental diseases classified on the newer nomenclature. They further report that of its type and on its own classification it could scarcely be improved upon; Sir Thomas Clouston had an experience of mental troubles as they affect patients drawn from a good class in society, and also amongst the ordinary pauper asylum types, which is given to very few, and he wrote the article just when his experience was ripest. We have therefore decided to reprint it unaltered for the present, but in the hope that in due time sufficient information may come to light to make possible an article on more modern lines.—A. R. S.]

Prognosis in mental diseases is affected not only by the nature and causes of the particular maladies, but also largely by the special anatomical construction and physiological functions of the brain. A correct prognosis is easy in some forms of

disease—for instance, in many forms of skin disease. But in dealing with an organ such as the brain, the most important in the body in its constitution and functions, the most highly integrated, the most complex, and the most sensitive to the effects of every environment outside the body, and to everything that takes place in its own working, it would be unreasonable to expect a very definite prognosis in most cases when it becomes diseased or disordered. Especially when its highest function of mind is disturbed, the difficulty of saying whether it will again resume its normal condition is often extreme. In addition to physical conditions of disorder, we are face to face with an entirely different set of conditions, viz., states of consciousness, intelligence, emotion, and passion. Disturbance of each of these may not only be a result of brain disease, but they may be its causes, and they may also act as a means of cure. Mental diseases are unquestionably the most difficult department of medicine. The higher forms of the brain-cell, being the vehicle of mind, are Nature's last and greatest effort in the evolutionary process which has been going on during the past æons of time. The full knowledge, treatment, and cure of these will be the high-water mark of medicine. Every such cell carries, in its molecular structure and in its biochemical mode of action, the organic memories of its ancestral cells, and with those memories it becomes subject to ancestral reversions and weaknesses. How subtle and imponderable must be the changes which cause the mild emotional depression perhaps felt in the morning and gone within an hour! Yet that depression in a more marked form may constitute a mental disease. The human brain is a cosmos in which are represented the working and the condition of every other organ in the body. There are few diseases to which the mind is subject where some organ or function of the body is not also disturbed, and there are many cases where, as a result of mental disease, we have also peripheral bodily disturbances. There are, however, some cases of mental disease where we cannot, by any means at present at our disposal, discover any bodily symptom whatever, the mind alone seeming to be affected, and where the prognosis seems to depend on mental means of cure alone. Prognosis in such cases must depend on reactions to mental stimuli, but it may be said generally that prognosis depends chiefly on bodily reactions to environment, diet, and medicine. If those reactions are favourable and there is no organic brain disease, the prognosis is usually good. The subjective state of the patient must always be taken into account, and especially his feelings of optimism, his belief that he will overcome the disease, and his power of will to fight against it. Personal equations of all sorts come in, both in regard to the doctor and the nurses, as well as the patient himself, for cure and prognosis.

The prognosis in mental disease must depend chiefly on the twelve following considerations, namely :—

1. The causes of the disease.
2. Its form and symptoms.
3. Its previous duration.
4. The brain heredity of the patient.
5. The possibility of response and reaction of mental and bodily symptoms to suitable treatment, especially to the restoration of sleep.
6. The sequence of the mental and bodily changes that have taken place during the attack.
7. The period of life of the patient.
8. The existence or not of signs of organic disease in the brain-cells.
9. The existence or not of certain abnormal bodily conformations and stigmata.
10. The tendency or not that may exist to relapse and recurrence of the symptoms.
11. The completeness or incompleteness of the improvement in the attack under treatment.
12. The temperament and race of the patient.

It need hardly be said that in almost every case both the mental and bodily symptoms present at the time, and that have existed during the attack, must be taken into account in any attempt to predict the course and duration of unsoundness of mind. In one case the mental symptoms will give better indications for prognosis, while in another the bodily symptoms, or the absence of them, will be more to be relied on.

The really scientific study of mental diseases only began in the end of the eighteenth, and the first part of the nineteenth, centuries. The physiology of the brain and its minute structure were only able to be scientifically studied well into the nineteenth century, and without the knowledge gained by this study a scientific psychiatry could not have been attained. The classification of mental diseases and defects was at first founded on mental symptoms alone. It consisted of four varieties, namely: mania, or states of mental exaltation; melancholia, or states of emotional depression; dementia, or conditions of permanent mental enfeeblement coming on in a brain that had once been normal; and idiocy, or congenital forms of mental weakness. During the latter part of the nineteenth century an enormous number of varieties of mental disease have been segregated, their foundation in different cases being etiological, pathological, and psychological. Some of these varieties, like general paralysis, must be permanent. Many of them are obviously transitory and experimental. Prognosis must depend to a large extent on a true classification, where that is possible; and in the present article I shall adopt the varieties which seem to me to have a scientific and practical basis.

Early in the scientific study of mental diseases attempts were made in this country, on the Continent, and in America, to draw up statistical tables showing the number of recoveries, the number of deaths, the liability to relapse, and the duration of the attacks; but in all these insanity was regarded as a whole, and its forms and varieties were not taken account of. The science of medical statistics was then in its infancy, and the registers of the various existing mental hospitals were very imperfectly kept, while there were no available facts to be obtained from records of private practice. Esquirol in France, Jacobi in Germany, and especially Thurnam in England, were the pioneers in the statistical department of prognosis in mental diseases. Farr helped greatly by pointing out the errors of previous writers, and in laying the foundation of general medical statistics on scientific principles. The figures and the general results of these authorities need not be discussed in detail in this article, as the chief aim of this work is not statistical but clinical, and to help the practitioner of medicine. Thurnam sums up the general results of the treatment of insanity in institutions in his time, that is, about 1845, in this way: "A proportion of much less than 40 per cent of recoveries on the admissions is, under ordinary circumstances, to be regarded as a low proportion, and one much exceeding 45 per cent is a high proportion". He says, in regard to the mortality rate among the mentally afflicted, "a mortality that exceeds 9 or 10 per cent is decidedly unfavourable", and one which is less than 7 per cent is "highly favourable", in asylums where all classes are treated. In regard to pauper asylums, a mortality which exceeds 12 or 13 per cent is "a very unfavourable one", and one which is much less than 10 per cent is "highly favourable". Since that time the rate of mortality has remained nearly stationary, in spite of the fact that far more cases of senile breakdown and organic brain disease with resulting mental symptoms are now certified as insane. My personal experience of the recovery-rate in 11,346 patients treated by me in the Royal Edinburgh Asylum during the thirty years 1874-1903, was that 39.4 per cent of them recovered. They included every variety of mental disease and defect which can be certified under the Scottish Lunacy Laws as unsoundness of mind or idiocy, but the number of cases of idiocy or congenital imbecility was comparatively small. I shall have in the course of this article to refer to the recovery-rate in the various forms of mental disease which have been under my care in two mental hospitals and in my private practice. The figures from the Royal Edinburgh Asylum have this advantage over those of county asylums and the registered hospitals of England, that they comprise the whole population, and are not confined to the rate-paid class as in the county borough and district asylums, or the class in a better social position who can afford to pay for their maintenance as in the registered hospitals. They also have this advantage, that they include the period (fifty years ago) when the number and variety of persons counted as technically insane, and certified as such for institutions, were more restricted than in the older times, and also the more recent years, when undoubtedly an extension has been given to the meaning of the term 'insanity'. Fifty years ago, before the Government grant was given towards the partial maintenance of every pauper patient, it was not so common as it is now to send to mental hospitals patients who suffered from various forms of senile decay, paralysis, and other incurable brain diseases. This is now done for two reasons: first,

the great convenience and the real benefit to such helpless persons of being properly treated in the hospital wards of county asylums ; second, the change of opinion that has taken place in regard to its being a discredit, if not a disgrace, to have a relation in a mental hospital. The general effect of this change of opinion and practice has been to reduce the percentage of recoveries in British institutions. There has been, however, another tendency in the opposite direction, namely, to send cases at an earlier period of their disease, and to send more transitory and alcoholic cases, both of which are apt to recover soon. In considering the statistics of institutions and of certified patients, this fact must be kept in mind, that mental disease in all civilized countries is not looked at and defined through the clinical symptoms present and from a scientific point of view, but largely through the provisions of the Lunacy Statutes. In this respect mental disease differs from all other diseases.

An important series of tables are given in the Reports of the Scottish Board of Lunacy for 1898 and 1913 (the 40th and 55th Reports), showing the 'progressive history' of 3858 patients for fifteen years after admission into mental hospitals. These throw a valuable but not a complete light on the prognosis of mental diseases, in regard to recovery and mortality. Of the patients of all classes, ages, and forms of mental disease, admitted into Scottish asylums in 1868 and 1898, the chief results in the fifteen years are as follows : There were 2252 'recoveries,' or 58·6 per cent of the whole. But those included repeated recoveries in many of the patients. In fact, there were 1230 re-admissions to the institutions, most of which resulted from relapses into mental disease, and some had such relapses several times. Some of the re-admissions were, no doubt, of the 781 who had left the institution not recovered. On the hypothesis that one-fourth of the 'recoveries' had been those of relapsed cases or of the previously discharged non-recovered, it would show a recovery-rate of 43 per cent.

The deaths during the fifteen years amounted to 1361, or 35 per cent of the total admissions.

One of the most striking and instructive facts about these tables is this, that it was in the first two years after admission that the greater number of the recoveries, the relapses, and the deaths took place. In fact, the general results of the mental attacks showed themselves in that time. Seventy per cent of the recoveries occurred then, 60 per cent of the re-admissions, and 45 per cent of the deaths.

Unfortunately these tables do not show how many of the recoveries relapsed into insanity. If the returns had shown how many of those who recovered had relapsed, and how many times, their value would have been enormously increased. If the heading after the first column had been "Relapsed after Recovery", instead of "Re-admitted", this result would have been obtained.

At the end of the fifteen years there were 694 patients of the 3858, or 17·9 per cent, left uncured in the institutions. An enormous 'movement of the population' takes place, in fact, among the insane as compared with the general population, as might have been expected.

In addition to the twelve general considerations which I have mentioned, there are many particular symptoms and indications which apply in all cases of mental disease in forming a prognosis, some of which I shall describe. Most of them are of importance in determining this particularly difficult point.

We ask in every case of mental disease, when trying to solve the question of the chances of recovery, How did the disease come on ? Had it the characters of a sudden brain explosion, a cloud coming into a clear sky, or was it a gradual evolution of mental symptoms beginning with slight psychical changes and evolving gradually from these into a more acute and marked disease ? In making inquiries to determine this important point, we have to go into the normal psychology and mental habit of the man or woman. For instance, we have to inquire into the ordinary strength and the indications of the social instinct. This differs widely in different individuals ; but if we find that the patient became, at a certain period considerably anterior to the mental attack, less inclined to mix with his fellows in social intercourse, to be more self-contained, more reticent, more secluded in his habits, and that this gradually went on to an active dislike of social intercourse, this becoming a real pain to the man ; if this went on further to a morbid suspicion of others, a misinterpretation of their conduct in regard to him, passing into

organized and fixed insane delusion, leading perhaps to assaults or homicidal attacks on others—this whole sequence of changes in the social instinct, if it took years to accomplish, would lead to an extremely bad prognosis of the case; while if somewhat the same symptoms were rapid in their course and sequence, say within a few months from their beginning to their full mental development, they might not mean anything like so grave an outlook for recovery.

Taking another form of mental disease, namely, that characterized chiefly by maniacal excitement with emotional elevation, the outlook in such a case differs greatly according to the innate and original qualities of the brain that suffers from it. If we have a case, let us say, with a bad mental or neurotic heredity, where during childhood there have been convulsions, night terrors, or other such signs of brain instability, and if we have, during the developmental period of the brain, tendencies to delirium or even short attacks of maniacal or depressed conditions or periods of lethargy and stupidity, the prognosis even in such a case need not be unfavourable, at all events until after twenty-five or thirty years of age.

The various epochs of life also, and their effects on the mental condition of men and women, cannot be left out of account in the prognosis of any of the diseases to which they are specially subject, but especially if those diseases are mental in character. Each epoch of life has its distinctive physiological and psychological characteristics. The prevailing dynamical and trophic activities are different at different times of life. The child period, when growth in bulk is the characteristic, the onset of sex, child-bearing, the decadence of power which marks the climacteric and old age, have all to be taken into consideration in prognosis. In almost any case of insanity we cannot dissociate the normal from the abnormal psychology—one influences the other. The insanity is often an evolution of the natural temperament. The same symptoms occurring at twenty-five and at seventy may mean a quite different prognosis in the two cases.

The time element in all forms of mental disease is of the greatest importance; in fact, in many cases this determines the prognosis. It may be laid down as an almost universal axiom that the chances of recovery diminish after the first year in the ratio of the duration of the attack, except where the epochs of life of which I have been speaking come in. We never give up hope of recovery in such cases until the particular epoch during which the attack has begun is passed. Different mental symptoms also affect the time limit differently. For instance, I was in the habit of laying down to my students this dictum: "Never give up hope in the case of melancholia while the depression of mind lasts". It is different with conditions of exaltation. If they persist for over a year or two, and take on the signs of chronic mania, the prognosis is bad; if symptoms of general enfeeblement of mind come on and last, say, for a year, the prognosis is almost hopeless. The same rule applies to conditions where we have regular periodic recurrences of the mental symptoms. If such persist for over a year or two they certainly make the prognosis bad. The typical instance of a recurring and alternating insanity is *folie circulaire*, and that is now regarded as almost incurable. There are certain gross diseases of the brain, such as certain forms of apoplexy and paralysis, which on their first onset are apt to be accompanied by mental symptoms; some of these are recovered from; at all events, the patients partially improve in mind, in such a way that they can no longer be regarded as technically insane; but if such mental symptoms persist more than, let us say, six months, the prognosis is unfavourable. The same rule applies to many of the cases of insanity caused by alcohol, opium, and other toxins. If the mind is disordered as the result of an acute toxin such as influenza, we expect it to be very short in duration.

Acuteness of symptoms is very apt to be considered by relations to be a bad sign in regard to the prospects of recovery. That is not so. I always like an acute case of any kind where organic brain disease does not exist, and tell the relations that it is one of the best signs that the case will recover quickly and perfectly. For instance, one of the acutest of all forms of insanity is that caused by child-birth, and yet none recovers so certainly, quickly, and completely. There is, of course, a greater risk of death in the acute cases, and this should always be explained to relations. Eight per cent of all cases of acute mania die of the disease, and the mortality in puerperal insanity is even greater.

Facial Expression in Prognosis.—The mental expression of the face and eyes in most cases of mental disease should be carefully observed. It is changed for the worse, and in some of the more acute varieties it is so changed that the man is almost unrecognizable by his friends. The only exceptions to this are in the case of persons who are, by temperament and natural disposition, slow, stupid, and lethargic. I have seen many such who, during a mild attack of mental exaltation, were brighter and better looking than ever they were before. There are only two facial disturbances of a decided kind that I think are unfavourable in prognosis. One is the heavy wiped-out expression of the face and eyes in the young man, and particularly in the young woman, who, towards the end of an attack of adolescent insanity, has passed, or is passing, into dementia. The other is the cunning, suspicious expression of the patient who suffers from paranoia of the persecutory type. All the ordinary disturbances of expression but these, however extreme they are, may be recovered from, and the patient resume his normal appearance.

The muscular expression of the emotions is not sufficiently realized in mental practice. There are fifty mind and eye muscles, not including all those of speech, the action of which makes all the difference in their mental expressions between one man and another. They are extremely small in size, but they are innervated to an enormous degree. Their motor nerves together are as bulky as those of the arm muscles, which weigh a hundred times as much. It is only when these mind-muscles of expression and eye show a certain disturbed mode of action which lasts for a long time, that such changes indicate a bad prognosis. Commonly they change quickly from good to bad expressions, and vice versa.

Causation and Prognosis.—The cause or causes of a mental attack have often much relation to the prognosis in the case. The causes which may determine an attack of mental disease are almost innumerable, and I cannot in this article refer to all of them. Commonly, when the history of a case is gone into, one finds that there existed more than one cause of the attack. There is often a predisposing, an exciting, and a proximate cause. For instance, a man may have a bad brain heredity as a predisposing cause, may have taken alcohol to excess as an exciting cause, and had a fall on the head as the proximate cause of his attack. Then in some cases there are even more than one exciting cause. I shall further on refer to heredity, which is the chief and most common of all the predisposing causes. There is a strong natural craving to find a cause for such a tragic event in life as an attack of mental disease. Relatives will press their doctor on this point very unduly, and if a cause can be assigned there is very often a sense of relief and a more hopeful feeling as to the chances of recovery. I often hear this remark: "I feel happier now I know the cause of the illness". The relations of our patients are exceedingly apt to assign causes which by no possibility can be the real ones. The causes which a mother will assign for idiocy in her child may be almost grotesque in their unreality. To account for a mental attack, relations nearly always seek a mental or a moral cause. In reality we know that only about one-fourth of all the cases of mental disease are due to mental causes, the other three-fourths resulting from bodily causes. Looking over the tables of the causes of the diseases which are usually attached to the annual reports of our large mental hospitals does not always help us very much. Many of the terms are too general to be of any scientific or prognostic use.

It may be assumed generally that a cause, or what may be reasonably assumed to be a cause, of a mental attack, will be less likely to produce an incurable brain malady if it is removable. Taking such causes as toxins affecting the higher brain-cells, most of them either exhaust their action on the brain quickly, or an immunity is set up, or they can be more or less counteracted by suitable treatment. I take as examples, cases of mental disease caused by or following the action of the influenza poison or syphilis or alcohol. These together cover a very considerable part of the era of mental disturbances. Then there are causes which are in their nature transitory, such as child-birth, many forms of bodily disease and exhaustion, surgical operations, etc. In regard to the mental and moral causes of psychical disease, many of them soon exhaust their deleterious action, or can be counteracted by changes of circumstances and environment; of such are overwork, some forms of domestic worries, love affairs, and mental shocks. On the other hand, there are causes that are almost necessarily irremovable, which therefore lead to a bad prognosis; such things, for instance, as traumatic injuries to the head, senility,

alcoholic excess so long-continued that the organic structure of the cells or vessels is changed, gross cerebral disease, epilepsy, etc. The mental symptoms may not be the main or original element in the case. They may be so secondary to bodily disease that the prognosis may depend almost entirely on the nature of such bodily causes. I would take as an example cases dependent on heart or uterine disease, on cancer, on diabetes, or on pernicious anæmia. Finally, the innate vulnerability and power of resistance of brain have to be taken into account when estimating prognosis in regard to causation. One brain may be upset by a cause which in another would produce no serious result at all. The unstable and vulnerable brain may, however, throw off bad effects far more readily and quickly than the more stable brain. Our modern methods of examination have enabled us to discover changes in the spinal fluid and blood and micro-organisms which are very valuable in regard to the prognosis in some cases.

Response to Treatment.—Every medical man is influenced in his prognosis by the effects of his treatment, using treatment in its larger sense of environment, nursing, and diet, and not confining it to drug treatment alone. If a patient, for instance, falls into depression of mind on account of unfavourable or local circumstances, and when he is sent away for a change at once begins to brighten and have his attention taken up with his new surroundings, it is necessarily a favourable sign in prognosis; or if, in any case, we have to do with thinness and general want of nutrition in a patient suffering from any form of mental disturbance, and our efforts to increase his weight by diet or drugs or change of air are successful, we think better of his chances of recovery. I have sometimes watched with so much anxiety the putting on of the first pound or two of weight in a patient whom I was treating, that my whole outlook became more optimistic when that took place.

Insomnia, so very common a symptom in most cases of mental disease, both as preliminary to and during the attack, gives us the greatest anxiety in regard to the effects of treatment. It is so very intractable, in some cases, that we feel the patient cannot recover his mental balance until it is subdued. Nothing is more exhaustive to the higher mental functions of the brain than prolonged insomnia. If by drugs, by change of air, by medical treatment, we find that the normal periodicity in the occurrence of sleep is restored, we feel that the patient will almost certainly recover in due time. Volumes have been written as to what sleep is, and as to the best methods of restoring it when insomnia is present, but we all feel that as yet neither of these problems has passed into the region of scientific certainty. We do surely know that sleep is the greatest and most important of all the examples of periodicity in the physiological and mental life of a human being. We also know that it is Nature's most important method of resting the higher functions of the brain and of restoring to a proper state of nutrition the brain-cells. Everyone who has thought about the subject realizes that the physiological unconsciousness of sleep is quite as mysterious as the occurrence of any mental disease whatever. Dreaming is the nearest physiological analogy to insanity. I believe that when we discover the secret of sleep it will lead to the discovery of the prevention of much mental disease.

Mental Hospital.—The response, favourable or otherwise, to the removal of a patient to a mental hospital undoubtedly affects prognosis in his case. Unfortunately, the ideas of many of the public regarding mental hospitals, and the feelings of repulsion and distress which those ideas have produced, in some cases tend to counteract the good effects of the control, discipline, régime, and medical treatment which are given in such institutions. Happily such wrong ideas are now undergoing a marked change, and a great many patients are willing to place themselves under treatment voluntarily in mental hospitals. This is the most satisfactory method of all in the cases where it is suitable. Unfortunately, the majority of cases of mental disease do not recognize they are ill, and therefore resent such treatment as being unjustifiable. But if a patient shows a marked betterment during his first month's residence in the hospital, it improves the prognosis in the case very much. Before going to such a hospital, the doctor has commonly to make the likelihood of an improved prognosis if sent there his chief argument for that course being adopted, and undoubtedly in the larger number of cases such a prognosis is justified by the results. Unfortunately, at present, the risk of danger to himself or others is rather too much of an element for the sending of patients to mental hospitals. In reality the great reason

should be the improved chances of recovery, and the impossibility among the poor of securing proper treatment otherwise.

There are a certain number of cases where the prognosis is distinctly improved by removing patients from mental hospitals to other environments. This occurs sometimes in a too prolonged convalescence, where such a change restores the interests in life and stimulates the patients to a greater amount of self-control. Speaking generally, however, I am of opinion that the best chance of complete recovery and of non-recurrence of the disease is secured by the patient's residence in the hospital until such recovery has not only taken place, but may be said to be established.

Danger of Recurrence.—In many forms of ordinary disease the patients are liable to a recurrence at some time or other after recovery has taken place. Gout, rheumatism, bronchitis are common examples of this tendency. Mental disease is liable to recur in at least 20 per cent of those who have recovered, and in many cases this tendency occurs over and over again. There are a certain number of cases where the more frequent the occurrence, the greater the danger is of a final incurability; but this does not apply to all of them. I have known many cases recover and relapse on very many occasions, the recoveries being good ones while they lasted, and the patient able to take his place in society and do his usual work. The classic case of Charles Lamb and his sister is an example. In many cases that have this tendency, the treating of the symptoms in time, before they have developed into serious mental disease, is the great principle to be adopted. Cure the insomnia, restore the nutrition, give a chance for brain rest, change the current of ideas and thoughts, remove causes of irritation or exhaustion, give a fillip to the mental life—these are all modes of effective treatment, and they improve prognosis in most cases.

Statistically the danger of recurrence is scientifically brought out in the Scottish statistics referred to on page 340.

Heredity as an Element in Prognosis.—The influence of a bad heredity in making any man or woman liable to mental disease has always been taken into account by those with experience in the medical profession. It was evident, on even casual observation, that some families were more liable to such diseases than others. Of recent years much more careful clinical and statistical knowledge on this point has been obtained. The ordinary methods of scientific statistics, and those of biometrics, have been called in to attain accuracy, with much, but not as yet complete, success. Dr. Karl Pearson and Dr. Mott are the latest authorities on this important subject, and their work has undoubtedly advanced our knowledge. For myself, I have much more faith in what may be called the clinico-statistical methods of Dr. Mott than those of the purely mathematical methods of Dr. Karl Pearson. Two things in regard to heredity I would especially impress on the readers of this article—the worst and the most direct heredity need not imply the occurrence of mental disease in any family; and the existence of heredity, even strong heredity, does not necessarily imply incurability in any case. We are nowadays continually asked about the liabilities to mental and nervous disease in certain families where there are intentions of marriage, proposals of insurance, uncertainties about taking to certain occupations or professions, and thoughts of going to live in certain climates. This reading of the horoscope of human beings is, or ought to be, a department of prognosis, and as our scientific knowledge increases it will become an extremely important part. It is already affecting the great science of education in a marked degree. It is affecting certain acts of the legislature that relate to social questions. It may be said to be affecting men's views of ethics and of human conduct. It has also a relation to literature, especially in history and biography. Long ago, in reading Carlyle's biography of Frederick the Great, one was impressed by the fact that that shrewd writer devoted his first volume entirely to Frederick's ancestry and relations, their history and characters. He did not use the word heredity, but that volume is a treatise on the subject notwithstanding.

The keynote of the new science of eugenics depends on heredity, and as a result of the perfecting of that science, prognosis, in a large sense, will be made far more accurate. It may be described indeed as the most comprehensive field of prognosis at present in existence, for all its aims consist of looking to the future in human life.

In the prognosis of mental diseases it is to be remembered that it is not the special mental defect or disturbance that is inherited, but a general defect of brain nutrition,

or an instability of action in the higher brain-cells, or a deficiency of resistance against toxins or against mentally upsetting causes. Heredity may consist, and in many cases of mental disease at the adolescent period does consist, of a want of ability to adjust the action of the brain-cells—the vehicles of mind—to the more complicated and evolved life of civilized man as compared with that of primitive ancestors. Dr. Mercier says: “The stability or instability of a person’s highest nervous arrangements depends primarily and chiefly on inheritance”. Without evil mental heredity there would be very little unsoundness of mind in the world. It is one of the chief problems of psychiatry. In considering the heredity of any case of mental disease with a view to prognosis, we must inevitably consider whether the defects in fathers or mothers, if any such exist, were personally acquired, or derived from an ancestry further back. To a large extent the belief as to the non-transmissibility of any personally acquired characters held the field till lately, but a newer generation of scientists are of opinion that, in certain circumstances, they may be transmitted. Professor Cossar Ewart, a great authority, as the result of practical experiments, says that “the germ cells are liable to be influenced by fever and other forms of disease that, for the time being, diminish the vitality of the parents”, and we have also the great authority of Darwin, Maudsley, and Hertwig for holding the same views.

If we find, in addition to a bad hereditary history, that there are bodily abnormalities in our patients, which we now call ‘stigmata of degeneration’, the prognosis is considerably worsened. In inquiring into the heredity of any case, we must take into account not only mental but also neurological facts, such as epilepsy, malformations, convulsions, chorea, asthma, stammering, hysteria, and many other such allied diseases. One law of mental heredity laid down by me long ago, and now fully confirmed on larger statistics by Dr. Mott, is that any mental defect in ancestry is liable to occur at an earlier age in posterity than the age at which it occurred in parents. It is also a fact that the maternal heredity towards mental and other nervous diseases is stronger than the paternal, and the mental defects tend to cross the sexes from mother to son, etc. It is also certain that while a strong heredity does not imply incurability to any one attack, yet it does produce a greater tendency to recurrence of the disease; and, finally, as a most important consideration in prognosis, few of us now doubt that in a vast number of cases a bad heredity can be counteracted, in some degree at least, or modified, by favourable environment and modes of life.

The Age of the Patients.—Youth, in mental diseases, as in all others, is a favourable element in prognosis, *ceteris paribus*. Some mental diseases, such as senile dementia, are incurable simply because the patient is old. Some others are apt to recover because they occur in the developmental period of life. Nature always tends towards health if she has a fair chance. Some diseases, such as choreic insanity, will almost necessarily recover because they are developmental in their character.

Completeness of the Recovery.—The prognosis in all our cases largely depends on whether the attack has been absolutely and completely recovered from. In mental disease, unfortunately, there are apt to be left certain of the slighter peculiarities of character and conduct. These, if they persist too long, are liable to become brain habits difficult to get rid of.

Temperament.—The original temperament of the patient, to a certain extent, determines the prognosis of his attack if he falls into certain forms of mental disease. Melancholia in a markedly melancholic temperament is not so curable as in a sanguine temperament. Mania is not so curable in the case of an excitable, boisterous, nervous temperament as in a man with an ordinary average working brain.

CONDITIONS OF SIMPLE MENTAL DEPRESSION AND ELEVATION— MANIC-DEPRESSIVE INSANITY,

Whatever classification of mental disease may ultimately be adopted, I am satisfied that there are certain morbid conditions which for the general practitioner and the relatives of patients it will always be necessary to reckon with and to treat as distinct forms of disease. The chief of these are states of mental depression and mental elevation with diminished self-control. From the earliest times in the history of medicine these have been recognized. The terms melancholia and mania have become a part, not only

of medical books, but of popular language and of literature. The conditions I am to describe are those which are apt to come under the notice of the medical practitioner in his ordinary work, commonly before a specialist is called in. It is essential, therefore, that right conceptions regarding their nature, causes, risks, prognosis, and treatment should be held by every doctor. Especially when they exist in a minor degree and constitute what we now call the 'borderland', it is important that they should be subjected to the right kind of treatment, and that their prognosis should be well considered. I believe if proper treatment is carried out they may be arrested in many cases, and recoveries may be brought about before they reach their more serious stages, the necessity of being placed in mental hospitals thus being avoided. I shall refer both to my experience in treating them in a mental hospital, and also as a consulting physician where I had to advise as to their treatment in private houses, in rooms, or in nursing homes.

Among the practical classifications adopted in most mental hospitals, conditions of depression are usually assorted into the varieties of simple, hypochondriacal, delusional, suicidal, resistive, excited, and stuporose. The cases of simple melancholia are those which the general practitioner of medicine sees most of from start to finish. It is the most rational of all the insanities. The patients themselves and their relations usually object to its being called mental disease at all. They talk of it as 'nervous depression', 'melancholy', 'low spirits', being 'out of sorts', and being 'run down'. I am not of course alluding to the cases of mere physiological depression of mind from natural emotional causes. Mere physiological melancholy might be defined as a sense of ill-being and a feeling of mental pain, with no real perversion of the normal reasoning power, no morbid loss of self-control, no impulses towards suicide, the power of working not being abolished, and the ordinary interests of life only lessened, not destroyed. The simple melancholia, whose prognosis I am to treat of, is a really pathological condition of the brain cortex, accompanied by mental pain, emotional depression, a sense of ill-being more intense than melancholy, with some loss of self-control or volitional power, perhaps a tendency to delusion of a depressed character, the power of doing ordinary work being greatly diminished or abolished, the interests of life interfered with, and with discoverable bodily symptoms in nine cases out of ten.

In the examination of such cases the patient himself is of the greatest assistance, because he knows he is ill, sometimes perhaps exaggerating his symptoms. The patient's 'objective consciousness' is morbidly acute, while his 'subjective consciousness' is exaggerated. Such a patient is usually run down in body, and has had some physical or mental antecedents which have been the cause of his trouble. There is usually more or less insomnia. The patient has either a jaded or a more or less irritable feeling, his work instead of being a pleasure is a conscious toil, he has a sense of ill-being, the opposite of that normal sense of well-being which is to all mankind the best proof of health. The nutrition of the body is lowered; commonly there is want of appetite, and constipation. The depression is nearly always worst in the morning. This is a fact well worth keeping in mind in treatment and prognosis, for certain measures can often be taken to rouse the brain from this morning depression into somewhat normal action. It is not often kept in mind that sleep, in addition to the marvellous condition of unconsciousness which accompanies it, does so alter the working of the higher cortical cells or their capillary circulation that they do not resume work for a little time after sleep is past. In a minor degree this is a common enough thing in people who are far from being mentally diseased.

Although the definition of this simple state of melancholia cannot be exact, it having no definite boundary lines from either sanity on the one hand, or the more severe varieties of the disease on the other, we can for practical purposes ask: What are its chances of recovery and its general prognosis, its liability to relapse, and the fear, if any, of a fatal result? The general prognosis is unquestionably a favourable one; but in order to give a statistical basis for that opinion I shall take my experience during the last ten years I was Physician-Superintendent of the Royal Edinburgh Mental Hospital, from 1897 till 1908. I must explain that while this condition of simple melancholia may usually be quite well treated at home if the patient's finances admit of it, it is expensive if practicable. For the poor and the 'lower middle class', most of the cases have to be

sent to mental hospitals, on account of there being no means of proper treatment, and of the patients not being able to earn their own livelihood. In the ten years I had under my care altogether 4319 cases of mental disease. Of these, 414 were cases of simple melancholia. It is therefore one of the most frequent of all the varieties of mental disorder. Of the 414 cases, 225 recovered, or 54·3 per cent. Considering that two-thirds of the remainder were discharged (technically relieved), and one-third of those probably completed their recovery after their return home, I think it would be a reasonably correct estimate to say that 70 per cent is the chance of making a recovery in this class. The rest of the cases, the 30 per cent, passed either into the more severe varieties of melancholia or into dementia, while a few died. Less than 1 per cent died, and that was through the exhaustion of acuter symptoms coming on, or through their becoming so low in nutrition that intercurrent diseases, such as phthisis, pneumonia, etc., carried them off. I may say very few of these cases of simple melancholia were really suicidal. All the suicidal cases, or rather the worst of them, I included under the separate heading of suicidal melancholia, but no doubt the general idea that life is not worth having, and some little risk of suicide, was present in some of them.

It is interesting to compare all the cases of melancholia, the simple and the more severe, as to prognosis, with the special group that I have called simple. There were altogether 1465 cases grouped under melancholia, including the simple variety, and of the total number 43·7 per cent recovered. Adding the proportion of the relieved, which is not so great as in the simple variety alone, the general prognosis as to recovery in conditions of depression of mind sufficiently severe to be sent to institutions may be put down at about 55 per cent.

Duration.—Patients themselves and their relations are commonly very urgent, not only as to whether recovery will take place, but how long the symptoms will last. This is the most difficult part of the prognosis in all mental cases. The grounds for giving a time limit are always somewhat uncertain; the data are commonly insufficient.

Simple melancholia, however mild in its symptoms, is not one of the mental disorders that we expect to pass off suddenly; its recovery is usually gradual, and we cannot count on a case recovering speedily because its symptoms are specially mild. There are some cases of simple melancholia that recover within three months, but, taking them all, their duration is over that time. We may, however, reasonably expect a recovery in this disease within six months from its beginning. Only about 10 per cent persist for over a year before recovery. Certainly three-fourths of the recoveries take place in that time. Its symptoms are so mild in many cases that it is difficult to say when a complete recovery has taken place. In the above estimate of recovery I assume that the patient has been for a month free from any symptoms of mental depression before the statistics are drawn up. Simple melancholia is one of the diseases from which a complete recovery is not only possible, but is likely to occur.

Indications of Improvement.—In nearly all cases of melancholia the symptoms are worst in the morning and forenoon, while the patients improve towards afternoon and evening. It may be held to be a good sign when the evening remissions are complete, the patient feeling quite well; and if along with this the morning exacerbation is not so severe as at the beginning of the disease, it is also a good indication. In most cases of melancholia the patients are not able to follow their usual occupation or any occupation in a continuous and efficient way, or if they do some work it is done with little interest and somewhat forced. It is always a good sign when a patient is able to resume any kind of occupation for any part of the day. We often treat such patients by keeping them in bed at first. If that has a good effect, it is a good sign as making for recovery. I constantly find, in the case of women who have been accustomed to that form of employment, that simple knitting is a most excellent occupation, being simple, not requiring any great amount of attention, and implying some muscular effort. When the patients become more inclined for active outdoor exercise it is always a good sign. If the stimulating nerve tonics, which we usually employ as a remedy in such cases, manifestly have an effect for good on the brain action, it is a good sign. Above all, if the patients gain weight steadily, and if their appetites and digestion improve, it is a favourable sign. Constipation being a frequent accompaniment of melancholia, it always means a general betterment when the bowels resume their normal action. If

the skin becomes softer and the perspiration more normal, it may be looked upon as favourable in prognosis. If the patients have had, as most of them have, an idea that they will not and cannot get better, and cease to be obsessed in this way, and begin to believe that there is a hope of their recovery, it is a sure sign that they are on the way to recovery. It is one of the great means of mental treatment to assure every melancholic patient that he will certainly get better, and I am in the habit of telling my nurses to reiterate this to every such patient at least a dozen times a day. This is a legitimate 'mind cure'. If the patient has been restless and that symptom diminishes, it is a good sign. If there had been any tendency to delusion and that diminishes in force, it is also a good indication that recovery is soon going to take place. There is a symptom which I have often noticed in cases of melancholia. The patients, during the earlier part of the disease, are often abnormally deficient in will-power and are too calm in temper. If a stage of irritability comes on I look on it as a good sign. I had one patient whom I was always glad to hear using strong language. I knew then that he was going to recover. The conscious sense of organic well-being is the last to come, that being the best subjective sign of health. A symptom worthy of observation is the return of minor neuroses or ailments to which the patient may have been subject, e.g., headaches, asthma, skin troubles, etc. When these are seen it is a good sign of approaching mental recovery. If a patient has had a quick and irritable pulse, and that disappears, it is a good sign.

Unfavourable Indications.—The following symptoms are those which make the prognosis more uncertain or entirely unfavourable. If the onset of the depression has been exceedingly slow and gradual, and its symptoms more and more serious in their development; if there is a gradual decay of bodily vigour, like a premature old age, and a persistent loss of nutritive tone and bodily weight that will not yield to diet and treatment, it is a bad sign. If hallucinations of hearing come on, we do not like it. If there are convulsive attacks or slight shocks of paralysis, we know that organic disease of the brain-cells has set in, and that there is little hope of mental recovery; but I have seen many exceptions to this. If the patient in facial expression takes on a prematurely old appearance it is not a good sign, or if the emotional depression of face and eye gets permanently fixed without any smile, or if muscular expressions of mental pain come on such as wringing of the hands, groaning, etc., or if a suicidal tendency develops and gets extremely intense, these are bad signs. If there are proofs of marked arteriosclerosis or other vascular degenerations, they add much gravity to the prognosis. If there is seen a general weakening of the mental power, the memory, power of attention, and interest in life, the patients becoming somewhat facile and too content, it is an indication that dementia is threatened, but simple melancholia is of all mental diseases one of those least subject to pass into dementia. As I have mentioned, however, hope of recovery should be entertained as long as anything like decided depression of mind exists, even for years. I have known a case of melancholia recover after twenty years. If the disease has come on during, or in consequence of, an epoch in life like adolescence, pregnancy, or the climacteric, recovery may be looked upon as more likely when such an epoch has passed away. Senility is not in itself an absolute bar to recovery. I shall refer to the fact, when I speak of senile insanity, that its melancholic forms recover in a reasonable proportion of the cases.

Periodicity and Recurrence.—The patients themselves and their relations are nearly always anxious as to whether the trouble is likely to return. The prognosis in regard to this must be somewhat guarded in all forms of mental disease, which, taken all together, recur in about 20 per cent of the recoveries. Simple melancholia is not a disorder that is specially apt to recur unless the temperament of the patient is an extremely sensitive one. A certain mental hypersensitiveness of disposition is, in my opinion, the psychological basis on which most cases of melancholia are implanted. It may be put down, in fact, as its chief predisposing cause. This hypersensitiveness is so extreme in some cases that its unfortunate possessors may be said to be always on the verge of simple depression of mind. I had a lady patient once who was liable to be thrown into such a condition on almost the slightest occasion of worry, distress, disappointment, or loss. She had several attacks when she lost relations, she had one when her favourite dog died, and she could never stand a too exciting sermon at church. Some persons with a strong neurotic heredity of brain are liable to depression during the

epochs of life I have referred to. Some people are liable to an attack whenever they overwork themselves, mentally or physically, whenever they have an attack of indigestion, or whenever they are 'run down'. Taking simple melancholia as a whole, the liability to recurrence or periodicity may be put down at about 15 per cent of all the cases. It is always a right thing for the doctor, when in attendance on such a case, to assure his patient that there is no chance of recurrence if he will keep his health in good condition and adopt means of treatment at the very earliest stage or if he should feel the least symptom of depression, loss of weight, or sleeplessness. I advise most of my melancholic recoveries to weigh themselves regularly. It is to be kept in mind that the slighter forms of depression are liable to occur as preludes to most other forms of insanity, and during the very first part of those attacks the doctor has to think of this in his prognosis.

Other Forms of Melancholia.—As I mentioned, melancholia occurs in the proportion of 35 per cent of all the cases of insanity sent to institutions. Taking all the cases who consult doctors privately on account of mental symptoms, I would say that mental depression stands in the proportion of at least 80 per cent. The general prognosis of all forms of melancholia is represented by the 43·7 per cent which I have referred to. While the simple melancholia of which I have treated is by far the most curable variety, it is not the only one that is curable.

Suicidal.—First let us look at the most serious of all the complications of melancholia, namely, the suicidal impulse. This is so common that it exists in lesser or greater degree in about four-fifths of all the cases of melancholia; but, in great intensity and constituting a serious risk, it only applies to two-fifths of the cases, and those we classify as emphatically the suicidal variety. It is a common idea that when a patient is strongly suicidal he is therefore incurable. This is certainly not a correct view. Its gravity and its risks should not make one take a despairing view of even a very suicidal case. They recover in as great a proportion as the ordinary cases, if we exclude the simple variety.

Delusional Melancholia.—The next variety of melancholia, which we call the delusional form, is much more serious than the suicidal in the prognosis. By this term is not meant melancholia with delusions. It is used to indicate that variety of the disease in which a delusion or delusions are from the beginning the most prominent symptom, in which they remain throughout the disease of the same nature, giving the attack a distinctive character, being what are called fixed delusions, in contradistinction to milder delusions that change in kind, or subject, or degree. The relatives of such patients are apt to call it the cause of the disease, when scientifically it is merely the most marked symptom. The real disease consists of the depression, the mental pain which is at the bottom of the delusion and underlies all the other symptoms. In such a case of delusional melancholia the prognosis is undoubtedly unfavourable, especially if the delusions last for over the first six months of the case. The delusional cases constitute about 25 per cent of the melancholics. The delusional and the suicidal symptoms may combine in the same case, and this constitutes a grave prognosis.

Homicidal feelings and attempts sometimes occur in melancholia, and constitute a grave element in the prognosis, without, however, indicating incurability. I have known many cases of simple melancholia with vague homicidal feelings, but the real danger of homicide is found chiefly in the excited variety of which I am about to speak, and at the beginning of the attack.

Excited and Resistive Melancholia.—Extreme agitation and excitement as a part of the disease may be the distinguishing characteristic of an attack from the beginning till near the end of its course, or it may occur as one stage in its complete clinical history. The patients in such cases rush about, may be violent to those about them, wander ceaselessly, walk up and down, and cannot sit still for any length of time, roll about on the floor, bite their finger-nails, or wring their hands, or shout, or groan, and weep loudly, or tear their clothes. In short, the muscular expressions of the pervading morbid emotion are strong, and uncontrollable by their wills. This really constitutes the worst variety of the disease, and by far the most difficult to manage, rendering institution treatment necessary in almost all the cases. The presence of this agitation is determined either by the intensity of the disease or the temperament of the patient. The Celtic

racers are apt to show it more than the Teutonic. Delirium tremens in the acute form may be taken clinically as representing excited melancholia. There are apt to be hallucinations of the senses in this form, and a toxic element in the etiology.

Along with excitement, or, in some cases, without much motor excitement, there are cases of melancholia which are intensely obstinate and resistive in their conduct. They will not go to bed, they will not undress, they will not do what they are wanted to, and some of them are stuporose in their character. The expression of face in these cases is utterly changed from the normal.

The excited and resistive varieties constitute what is often called 'acute' melancholia. The prognosis in such cases is worse than in any form of the disease. It is apt to run on into a chronic condition, or the patient dies of exhaustion. Certainly not more than one-fourth of such cases recover. These forms are often associated also with a strong suicidal tendency.

Hypochondriacal Melancholia.—A somewhat distinctive form of the disease is characterized by hypochondriacal symptoms in which the mental pain has a certain want of intensity, and takes the form of fancies which centre round the patient's own health. He thinks he is all out of sorts, that his digestion is wrong, that his stomach is out of order, that his heart is weak, that he is certainly going to die of paralysis or some other trouble which is really imaginary. There are no limits to the fancies of the hypochondriac. Now this class of symptom adds considerably to the gravity of the prognosis. Such patients are not apt to recover quickly, and more than one-half of them do not recover at all. They are a very troublesome class to the doctor, because the patient is continually wanting to see him and pour out accounts of his imaginary illnesses to him. Although the ills the patient complains of may be entirely absent as real objective facts, yet they represent an organic sense of ill-being and are quite real to his consciousness. There is little risk of suicide in the prognosis in these cases, except in the very worst class of them. Suicide is often talked of and threatened, but seldom carried out. In ordinary cases of melancholia, when a patient is deeply depressed, he says little about suicide but thinks a great deal of it. These are the really dangerous cases. When a man is constantly talking of suicide, as sometimes in the hypochondriac, there is certainly very much less risk of his committing the act; but still I have known it occur even when it had been much spoken of previously.

States of Depression as seen in Private Practice.—The statistics of these conditions as met with in private and consultation practice are perhaps more instructive to the general practitioner than those of institutions, even if they are not quite so exact. The patients are mostly in the early stages of the disease, and they are still living under the ordinary home conditions of treating disease. They are in every way more analogous to cases in ordinary practice. As the results of such treatment are not to be found in the text-books, I give them here.

I have taken the last 200 consecutive cases that I have seen in consultation and have analyzed them. I find of the 200 there were 104 who laboured under depression of mind, who mostly knew they were ill, and had themselves desired or were persuaded to consult a mental specialist for their symptoms. I usually had the advantage, too—a great one—of getting the previously acquired knowledge of the family doctor as to the patient's previous history and mental symptoms that had appeared. I was not able to follow the mental history of all these patients—that is one of the disadvantages of a consultant. At least 21 of them thus passed out of my medical knowledge. But I know that 88 of the 104 were said to have 'recovered', that is, a total recovery-rate of 84 per cent. That represents the curability of the *present attack* in the milder cases of melancholia. If one relied on this experience, a condition of depression would seem to be a very curable disease indeed. But I knew many of them would be likely to relapse, some of them over and over again. My inquiries into that point brought out this fact. I ascertained that 36 of them had recurrences or relapses, and I have no doubt that number does not represent the full facts. Deducting this 36 from the 88 'recoveries', it leaves a proportion of exactly one-half as being possible permanent recoveries. The relapses did not take place in many of the patients for years, so that in them the 'recoveries' were just as real as recoveries from gout or rheumatism and many other diseases often are. I knew that at least ten of these relapses passed

into *folie circulaire*, or dementia, or other incurable mental states. Almost all these patients were in comfortable circumstances, so that they could afford to obtain skilled nursing, changes of environment, etc.

Melancholia is apt to be the first form of mental disturbance when it occurs in any family up to that time free from it. Being the sanest form of mental disturbance, it is the most curable, and the least damaging to the brain when it is recovered from.

Premonitory Symptoms.—In the early stages of melancholia, the patients very frequently have a sense of impending danger, of loss of self-control, and that they may take their own lives. This feeling causes great distress, and aggravates the painful symptoms of the disease very much. It is certainly a symptom that is not to be disregarded in the prognosis, and especially in regard to the precautions to be taken. The patient perhaps does not speak of it to anyone but his doctor. Relatives usually pooh-pooh the symptom as not being worth taking much notice of, because the patient at the time is self-controlled, and can pull himself together and look very much as usual in the presence of strangers. One of the difficulties of its treatment and prognosis is this, that constant watching, though it may be necessary in many cases, may add greatly to the patient's depression, thus aggravating the disease; the watching against the symptom, in short, acts as a continual suggestion that it is present. There are three kinds of cases which, in my experience, make it almost impossible to provide absolutely against attempts at suicide. Those are, first, these latent early cases, and secondly, those where, during the course of the disease, explosions, as it were, of suicidal impulse come on suddenly without any preliminary symptoms. The third is where the patient exhibits extreme cunning in concealing his impulses and extreme determination in carrying them out. As regards the doctor in attendance, wherever there is any suicidal impulse, or any reasonable clinical risk of it, he is bound to take precautions and to intimate its existence, in an earnest, impressive way, to the nurses and attendants and to the responsible relatives of the patient.

CONDITIONS OF MENTAL EXALTATION—MANIA,

Both the symptoms and the prognosis are different where we have emotional and intellectual exaltation as the chief symptom, as compared with the depression of which I have been speaking. Exaltation in any form is a more insane symptom than the milder degrees of depression. The patients usually do not recognize they are ill, as the melancholics so frequently do. There are conditions of what may be called physiological exaltation, as in healthy childhood. A grown-up man or woman who behaved like such a child would be in a condition of mental disorder. Then there is the natural exaltation of feeling resulting from good news or good fortune. This may, in some cases, pass into pathological exaltation in certain temperaments. A certain transitory kind of morbid elevation is apt to occur as a complication of fevers and other diseases in children of a strongly neurotic temperament. We think differently of conditions of depression and of exaltation. The former we are apt to think of chiefly from the patient's own subjective point of view, the latter from the objective evidences of his conduct and speech. There are certain conditions of exaltation where joy, pleasure, and happiness are the characteristic emotional states, and there are others where rage, discontent, and irritability are its chief manifestations. Most cases of mania are accompanied by 'excitement', that is, have visible muscular acts as its symptoms, whereas in simple melancholia no such excitement need be present.

As a clinical fact, mania divides itself into varieties, just as melancholia does, and the character of these varieties markedly affects the prognosis in individual cases. The chief of these varieties are the simple, the acute, the delusional, and the chronic.

Simple Exaltation.—I had under my care, during the ten years 1898–1907, in the Royal Edinburgh Mental Hospital, 800 cases of simple mania out of 1754 maniacal cases altogether, and, of that 800, 348 recovered, giving a favourable prognosis of 43·5 per cent. In addition to those recoveries, a certain number more were discharged relieved, some of whom no doubt completed their recovery after leaving the institution, but there were not nearly so many of such relieved patients among them as among the melancholics. I think if 5 per cent were added to the 43·5 per cent of recoveries, it would represent the total curability of conditions of exaltation so marked as to be certified insane.

This gives a prognosis in such states of 10·5 per cent less than that among the depressed, in the simple varieties of the disease.

In the general outlook of a patient who suffers from morbid mental exaltation, there are different risks and different things to be considered from those suffering from depression. An exalted patient will commonly not commit suicide, or think of it. He will attract more attention from others of an unfavourable kind; he will be looked on as more of a 'fool'. He will have far more chance of losing any work or situation he has, he will be more likely to ruin himself by foolish action or speculation, he will run more risk of getting into the hands of the public authorities, and he will be far more apt to produce disturbances in his family and social relations. The greatest of all human faculties, that of will power and self-control, is very much more weakened. His moral sense is lessened in such a way that he is liable to commit acts of immorality; the conventionalities of life are lessened in him, and he sets them aside. In his dress, and in the company he keeps, he changes his normal habits. He is much more frequently, and is sooner, certified to be insane and sent to an institution for care and treatment, and from the beginning this contingency is to be kept in mind by the doctor and explained to the relations. It is more easy to persuade relatives that this step is necessary than in the case of depression of mind. Mental exaltation is not so apt to be gradual in its beginnings as depression. It comes to a head faster. There are fewer cases of simple mania in the total number of cases of exaltation compared with melancholia. It is characterized less by nutritional defects. The man suffering from simple mania eats well, sometimes an excessive amount, and keeps up his strength. His temperature is slightly higher than the melancholic. Instead of putting him to bed and giving him rest and massage as a form of treatment, we tend in most cases to give him a great deal of exercise in the fresh air, to put him to dig, or to send him away on a walking or bicycling tour with his attendant or a friend. We are far less sure of what he will do and of how the case will turn out than where we have simple depression.

Comparing simple exaltation with all the other forms of mania, the percentage of recoveries is only about 3 per cent greater, thus showing that there is not so great a difference between simple mania and its other forms as between simple melancholia and other forms of depression. It is in fact not so curable a disease. The brain is more disturbed in its action and not so liable to recover when exaltation is present as when the disturbance consists of depression. The 414 cases of simple depression sent to the institution in the ten years, as compared with the 800 cases of simple exaltation, is not a proof, in my opinion, that the exalted conditions are more frequent, but that they are of a character that cannot readily be managed at home and are therefore sent to asylums much more frequently.

Recurrence.—I have no quite definite statistics showing the liability to recurrence in cases of simple mania, but my opinion is decided that it is more liable to recurrence, and certainly it is more liable to pass into other and deeper forms of mental disease, than states of depression.

Acute Mania.—This state, being the most vivid and dramatic of all forms of mental disease, is very often taken as the type of all the insanities. It is the 'raving madness' of literature. It is the least rational, the least conscious, the most noisy, and most unmanageable of all forms except general paralysis. Unfortunately, being thus so very distinctive, it has affected the conception, the treatment, and the prognosis of all forms of mental disease in a very unfavourable way until recent times. The man in the street thinks of every case of mental disease as of this type. Its treatment in old times consisted of manacles, chains, darkness, and stripes, and its prognosis was usually put down as entirely hopeless. It is not really a common variety of mental disease, for, out of 2377 admissions into the Royal Edinburgh Mental Hospital during the seven years 1874–1880, only 297, or about 8 per cent, were so classified.

Acute mania begins in various ways, sometimes by the condition of simple mania, but often quite suddenly. At times it has the melancholic prelude to which I have alluded. Bodily symptoms are more apt to be present than in most varieties of insanity except general paralysis. The temperature is raised, weight is rapidly lost, and great exhaustion occurs in a short time in most cases. The prognosis as regards recovery is not nearly so bad as was formerly thought. My experience was that 60 per cent of the

asylum cases recovered, $7\frac{1}{2}$ per cent died, $32\frac{1}{2}$ passed into chronic mania and dementia. This liability to a fatal issue is greater than in any other form of mental disease except puerperal insanity and general paralysis. There is no form of mental disease where there is more liability to the brain losing its higher powers of mind and sinking into an incurable mental condition. That in fact is the greatest risk of all, and the greatest anxiety to the doctor who is responsible for its treatment. There is a very acute form of mental disease, called by many authors 'delirious mania', or acute delirium, which clinically may be reckoned as the worst type of acute mania. In that form the prognosis, in regard both to recovery and to death, is very much worse than in ordinary acute mania. Some authors say that delirious mania is almost invariably fatal, but that is not my experience. In some books this is called typho-mania. The present opinion in psychiatry tends to put down almost all cases of delirious mania, and many of acute mania, as being forms of brain toxæmia, although no specific organism has as yet been detected. Certainly the high temperature, and many of the other symptoms, point to a toxin whose action has focused itself, as it were, on the higher cortical brain-cells.

Good Indications for Prognosis.—If the disease has come on suddenly, if the great organic functions of the body are not especially affected, these are, of course, good signs. If the stomach and bowels and digestion are acting in a normal way, if the heart's action is not unduly weakened, if the temperature does not rise above 101° , if the common sensation is not unduly impaired, if the mucous membranes of the mouth and throat are not dry, if weight is not lost at the rate of more than four pounds a week, and if the general strength shows no signs of exhaustion during the first fortnight, then we may have good hopes of the patient's ultimate recovery under proper treatment. If he begins to put on weight rapidly, it is perhaps the most favourable bodily sign of approaching recovery that can appear. If the disease does not last in its acute form more than a month, if there are no signs of a general enfeeblement of mind after the first six or twelve months, if there is no tendency to fixed delusion, these are all good indications in the prognosis. Nowadays we commonly put our acutely maniacal patients to bed for the first few weeks, and if this is successful in calming them, we look on it as a favourable indication. If prolonged bathing treatment is adopted, and the patients submit to this quietly and are the better for it, that shows that the attack will probably be recovered from. If this treatment by warm baths, with perhaps the use of mild sedatives, has the result of soothing the patients' excitement in a marked way, their recovery will probably be speedy. If the habits are not very uncleanly, and improve under care, it is a good sign.

Unfavourable Indications.—If the temperature is persistently over 101° , if the loss in weight amounts, as I have seen in some cases, to fourteen pounds in a week, if the mucous membranes are persistently dry, if there is a 'muttering delirium' at night, and if there are marked signs of general exhaustion with heart failure, these are all unfavourable indications as to recovery and life. Some cases of acute mania die from exhaustion in spite of everything that can be done, and some of these die very quickly and suddenly, within the first fortnight. We now think that in such cases the toxæmia has been of a very acute character. If there have been hallucinations of the senses and they show a tendency to persist, it is an unfavourable sign. If the acute symptoms are entirely intractable and go on for perhaps a year without much change, we fear that it may pass into chronic mania. But the result which we dread above all things is that of dementia, of which I have spoken, and the early symptoms of this consist of a diminution of the active maniacal symptoms, a blurring and deterioration of the expression in the face and eye, a lack of the power of attention to what is going on, a want of interest in the people about him, or in suitable occupation, a persistent lack of orientation, and a lowered emotional condition, with a loss of social instinct and the persistence of very dirty habits—all these, especially if the patient is in the period of adolescence, are unfavourable indications for complete recovery. They mean that the brain-cells are undergoing demonstrable deterioration or atrophy. This affects at least 50 per cent of all the cells in bad cases.

Tendency to Recurrence or Complete Recovery.—Acute mania is a condition which is not apt to recur, and when it has been of short duration it may be completely recovered from and leave the brain and the man in a normal condition.

Chronic Mania.—This is really, as to its symptoms, acute mania somewhat modified in certain particulars and running a chronic course. I put down the time limit here as twelve months, but undoubtedly there are some cases of acute mania who recover after that time. Chronic mania is an incurable disease, but many patients live a long time suffering from this condition. There is a spice of enfeeblement of mind in chronic mania, the memory is impaired, the habits and fine feelings are degraded or dulled, the emotional power and social instinct are usually almost paralyzed, and the power of attention is usually much lessened, although some patients are extremely sharp and observant.

Delusional Mania.—Some cases of mania have from the beginning a strong and fixed delusional element on which the symptoms of excitement seem to hang. A man believes that he has been persecuted by his relations and friends, and he seems to get excited *in consequence* of this delusion. I had a patient who shouted, scolded, and was violent, almost all day, alleging as the reason of her conduct that her children were below the boards of the floor, and that she heard them constantly being tortured by villains who were killing them. The prognosis in this form of mania is certainly unfavourable, though individual cases sometimes recover. It is often accompanied by vivid hallucinations both of hearing and sight, and these are unfavourable, particularly the auditory hallucinations, if they last long.

Mania in all its Forms—Statistics.—Taking every form of morbid mental exaltation, I had 1757 cases in the Royal Edinburgh Asylum during the ten years I have referred to, of which 715 recovered, which gives a percentage of 40·7, being 3 per cent less than that of melancholia, and I think that the patients who were discharged relieved did not recover at home in anything like the same proportion as the melancholics did. About 5 per cent may be added to the 40·7, making about 45 per cent as a general prognostic chance in mania. The whole number of cases of mania was 1757, as compared with the 1465 melancholics, during the ten years; but, as I have stated, this does not represent the real liability to depression and exaltation of mind in the population.

Turning to conditions of morbid exaltation seen in private practice, I had 31 of these out of 200 consecutive cases, or 12 per cent, contrasting thus with the 52 per cent of cases of depression. Twelve of the 31 recovered, a percentage of 39, as compared with the 88 per cent of the melancholics. I ascertained that 5 out of the 12 recoveries had relapses, or 41 per cent, which is the same proportion as the melancholics. The lesser number of elevated cases I saw as compared with the depressed may not necessarily prove a lesser occurrence of morbid elevation in the brain-working of the community, but be due to the fact that patients suffering from mania are less apt to come or be brought to a consultant. They usually do not recognize they are ill, and they are so decidedly more insane that they are much more apt to be removed to mental hospitals at once. The lesser percentage of recoveries I met with in private practice among the cases of mania may be partly accounted for through the greater mildness and manageability of the symptoms in melancholia, so that many more of them could be treated at their homes or in rooms during the curable stage of their attacks.

‘Manic-depressive’ Mental Disease.—All authors on mental diseases had noticed a certain relationship between cases of mania and melancholia. I stated in my “Clinical Lectures” that “there exists in the majority of nearly all the acute cases, at some time or other, in some form or degree, in some stage of the disease, a tendency to alternation, periodicity of symptoms, remissions, or recurring relapses”. My statistics showed that about 44 per cent of all my cases of insanity showed those characteristics, but, by confining ourselves to cases of mania and melancholia, at least 46 per cent had these special features. All physicians in charge of mental hospitals knew that certain cases of mania might become depressed, and vice versa, during the same attack, also that a patient might come in at one time with mania and his next attack would be melancholia. We all considered that those two conditions had a certain relationship to each other, but it was reserved for Kraepelin, of Munich, to throw the two conditions into one for purposes of classification, and call it “manic-depressive insanity”. He maintained that a very large number of cases of either condition actually had some symptoms of the other, if the whole mental life were taken into consideration. His subsequent experience and more careful study of the subject has led him to the belief that there are practically no cases of mania that have not had a melancholic phase, and that there are perhaps a few more,

but not many, cases of melancholia that have not a maniacal phase. His general conclusion from these facts is that, in essential nature and as forming the basis of a true classification, they all ought to be thrown together and called by one term—not two. That there is a great deal in this view few of us doubt, but our experience as to the almost universal frequency of the association of the two conditions has not been the same as that of Kraepelin. Either we have not observed those phases, or Kraepelin has been biased and has seen slight depressions and elevations which have not been visible to most psychiatrists. From a clinical point of view, especially as to treatment and management, a case of depression is largely different from one of mania, and, as we have seen, the prognosis is different. One can scarcely imagine telling the relatives of a typical case of simple depression of mind that it is one of ‘manic-depressive insanity’. It would obviously be more satisfactory and intelligible to both the medical attendant and to the relations to call it a case of mental depression. The psychological, and especially the emotional, condition in the two varieties is so essentially different and opposite that, even from a scientific view, Kraepelin’s classification does not seem altogether satisfactory. It is only in the very decided cases, where the depressed and elevated states alternate regularly and have a definite and calculable relationship to each other, that we are bound to regard them as different phases of the same brain condition.

The general prognosis in Kraepelin’s manic-depressive insanity is represented, according to my experience, by a 42 per cent recovery, rate in the cases treated in institutions, and if we add 8 per cent for recoveries at home, we arrive at a prognostic chance of 50 per cent.

States of Marked and Regular Alternation and Periodicity—‘Folie Circulaire.’—This is not the place to go into the most interesting subject of the physiological periodicity of function in all living creatures, except in so far as it relates to prognosis in mental diseases. The two most marked periodicities in man are sleep and the processes of reproduction. Both are disturbed in mental disease, and disturbances in both markedly affect its symptoms and prognosis. We cannot dissociate the physiological periodicities from the pathological alternations and similar changes in disease. Many recurrences and changes in mental disturbances are accounted for by reference to the physiological periodicities, especially in youth, when we have to do with sex and menstruation. An attack of mental depression or of elevation may be a pathological representation of the physiological effects of menstruation. If we have such a pathological mental periodicity established as a morbid habit, it is very difficult to get rid of, as might have been expected from this relationship to a physiological process. The prognosis therefore becomes bad in such a case.

There is no doubt that when we have a neurotic diathesis and a bad brain heredity we are more apt to have an exaggeration of physiological periodicities in the direction of disease. Everybody who observes men and women from a psychological point of view knows that the slight morning change of mental condition as compared with the evening, which may be said to be physiological, is greatly exaggerated in the neurotic subject, taking the form of a regular morning depression or want of power of energizing, or some vague feeling of organic discomfort. Most men and women of the finer and more sensitive artistic temperament experience some such feeling, and we have seen that simple melancholia often has the same features. The periodicities of morning and evening temperature are markedly altered in the acute insanities. There is no more common symptom in all forms of recent mental disease than insomnia, which means the ceasing of a brain periodicity. Seasonal periodicities exhibit themselves in many of the neurotic and the insane. They are not always in the same condition of mind in the spring as in summer. Some such people are subject to moods, cravings, obsessions, and tempers periodically. There are many persons whose mental life is one long alternation of action and reaction, activity and torpor, as if by a natural law of their organization. There are very few of the neuroses, in addition to the mental disturbances, that are not more or less periodic; for instance, neuralgia, asthma, megrim, and, above all, epilepsy.

There is a form of mental disease, called *folie circulaire*, first described by French medical authors, in which, when it occurs in a typical form, there are weeks or months, or even, in some cases, years of morbid depression, followed by somewhat the same periods of morbid elevation, and then by a condition which is practically sanity. This sequence,

forming a kind of circle with three sections, goes on during the whole lifetime of the patient in most cases. Once fairly established the prognosis is extremely bad. In my experience there are not more than 5 per cent of recoveries. The terminations of this disease, other than these few cases of recovery, are : first, exhaustion during the maniacal phase of the disease ; second, death from old age at the usual periods of life ; third, a sort of settling down into either a milder form of periodicity or into a stuporose condition during old age. Nearly 20 per cent undergo this change. Very few indeed of such cases pass into dementia, however acute the elevated phases may have been.

In the majority of cases of my 'adolescent insanity' there is a tendency to remission and periodicity before either recovery or dementia sets in, and we must be very careful in the diagnosis and prognosis not to pronounce them cases of *folie circulaire*. In fact, we must have several years' duration and very many successive and regular states of alternation before we definitely make the diagnosis.

Patients suffering from *folie circulaire* usually live long. The acuter cases are very troublesome, and usually need institution treatment ; but there are many people in the world who have what is virtually a very mild form of *folie circulaire*, and during the elevated periods do uncommonly good and sometimes brilliant work, and during the depressed periods are simply 'lazy', stupid, and inactive. They do not need to be put under care at all. I could quote from literature many examples of men who put out their best work during periods of slight mental exaltation.

The favourable indications in *folie circulaire*, in the rare cases where such are met with, are a lengthening in the periods covered by the whole circle, a mitigation in their character, and an improved self-control during the period of elevation, the depression being less intense and the elevation less maniacal. I have been in the habit of trying in the early stages of *folie circulaire* to control and stop the elevation by the use of the bromides, sometimes combined with sulphonal and cannabis indica. I think I can say that in a certain number of cases this has been done and the morbid mental brain habit has been, as it were, stopped. This is worth trying ; but I can recall one or two cases where the result of this treatment has been that the patients sank into a kind of lethargy and did not come out of it, ceasing to have any elevations and depressions. On inquiring into family history we find that cases of *folie circulaire* have nearly always a mental or a neurotic family history. It is found in a typical form more frequently in members of 'old' families, and many such families have had other members of great intellectual distinction.

OTHER FORMS OF MENTAL DISEASE.

Delusional Conditions—Monomania, Paranoia.—Delusion is a term which is not easy of definition. It has a popular and a medical meaning. If any man or woman has a fixed belief in something that would be incredible to people of the same class, education, or race as the person who expresses it, this belief persisting in spite of proof to the contrary, we say he or she has a fixed delusion. If such a delusion continues month by month and year by year, the prognosis is extremely unfavourable. It is only in exceptional cases that such persons recover and do good work in the world. The *fixity* in such cases is the character which means the incurability. Such false beliefs and delusions may assume almost every character. They may refer to the patient himself, his health, his organic and primary instincts, such as sex, food, and social relations, or they may be of a general and impersonal nature, referring to society, to other individuals, to political matters, etc. They may or may not be accompanied by hallucinations of the senses, but if they are it is a particularly incurable sign. A man's whole mental life may be of a delusional character, or the delusion may refer to one subject alone, being then called monomania. Delusional conditions are usually divided psychologically into two kinds, one of elevation and often unreasonable happiness ; the other of persecution, suspicion, unseen agencies, and irritability, danger, and general unhappiness in life. Delusional insanity is often founded on the temperament of the individual. Vain men fall into the delusion that they are much more able or hold higher positions than is the case. Suspicious men get to believe that their relatives and friends or society are persecuting them.

A modern psychiatrist, when he is consulted about a case where there is a tendency to insane delusion, or where there are hallucinations of recent origin, first looks out for

some bodily cause of this brain and mental change. He endeavours to ascertain whether there is any toxin circulating in the brain from without the body or from within. It is one of the common results of the excessive use of alcohol to find delusions of suspicion and hallucinations of the senses. The syphilitic poison often produces the same result. I believe the toxic effects of the breaking down of tubercle bacilli in phthisical patients sometimes causes mental disturbances through their action on the brain-cells—a condition which I have called ‘phthisical insanity’. There is a rare but well-known form of mental disturbance, liable to occur during attacks of acute rheumatism, which is undoubtedly caused by the rheumatic poison or micro-organism. There are also the myxœdematous and exophthalmic forms of mental disturbance. I would advise every medical practitioner not to come to an absolutely unfavourable prognosis in cases of delusional insanity before he has made a thorough investigation into such possible bodily causes for the disease and estimated the chances of counteracting or getting rid of them. No doubt toxins may have the effect of damaging the brain-cells irretrievably, but in some cases of delusion they may be counteracted, and in that way the patient cured if taken in time. Of recent years many of our younger psychiatrists have been trying the effects of various serums and vaccines, used in the early stages of such cases, as cures and counteractives, but their success has not as yet been great. This is a field, however, from which we hope much in the more acute toxæmias; but I cannot say that in the cases of paranoia there has been as yet much success except in certain cases of syphilitic origin, and then I have seen marked benefit, and even cure, by the use of antisyphilitic remedies, combined of course with moral and mental treatment, occupation, changes of environment, etc. There are now a considerable number of cases on record where a condition of fixed delusion was caused by traumatic injury to the head, and where surgical operation by trephining cured the disease.

There is a legal aspect of insane delusion, as there may be in most forms of mental disease, where we have homicide, suicide, and serious bodily injuries done as the result of delusions. It is often important to be able to give evidence that such cases are the result of mental disease. There are a certain number of the cases of paranoia where delusions are concealed, and their presence is even consistent with occupying positions of responsibility and doing good work in the world. In such cases the prognosis specially applies where wills are made and are influenced by the delusions present in the patient’s mind. I have been frequently consulted about persons with delusions who have exhibited them to no one except their nearest relations.

Magnan, of Paris, has described what he terms a ‘progressive systematized delusional insanity’, characterized by four stages: (1) Insane interpretations and slight depression; (2) Ideas of persecution, with hallucinations of hearing; (3) Delusions of grandeur; and (4) Dementia. My experience is that this systematic course, while it undoubtedly is seen in some cases, is a rare one. Delusional insanity is sometimes a part of that ‘degeneracy’ and ‘hysteria’ which Max Nordau so vividly describes as influencing our present-day literature and art. If this is so, and where it exists, it is certainly an incurable human tendency.

Defective Control, Insane Impulse, Insanity without Delusion, Exaltation, Depression, or Enfeeblement.—There can be no doubt that man’s power of will, his self-control, and his ability through the exercise of his volition to regulate his conduct so that he lives within the limits of the law and of good morals, is his highest faculty. When this great power fails in a marked degree, and men and women act from pure unreasoning impulse, and especially if such action is sudden and explosive, it undoubtedly means disease. Under the influence of such uncontrollable impulses suicide and homicide are sometimes committed, and many crimes and anti-social acts result. Such loss or weakening of the power of mental inhibition must, however, be very marked to class it as a disease. After all, control in all men is a question of degree. Mental inhibition is a faculty which does not exist in early childhood, and it grows during childhood and adolescence just as the bodily powers and faculties develop. A careful study of different children shows that there is an extraordinary difference between the degree and the development of this power in different children of the same ages. This development is, or should be, associated with a growing sense of right and wrong, and of duty in regard to parents, relations, society, and the Almighty. There are cases where such power of action and such a

sense of right and wrong is never developed at all. We now call such 'moral imbecility,' and for the first time this condition has lately been recognized in Bills before Parliament, and statutory provisions are now proposed for the care of such persons, just as we have similar provisions for the care of the insane. The Royal Commission on the Care and Control of the Feeble-minded thus defined such moral imbeciles: "Persons who, from an early age, display some mental defect, coupled with strong vicious or criminal propensities, on which punishment has little or no deterrent effect". It will be observed that the words 'mental defect' are used by the Commissioners, and it is quite true that there is a real mental defect, which, in most cases, involves the intelligence and the emotions; but there is a condition of loss of will power and moral sense in a few grown-up men and women without intellectual impairment. Some such are sometimes extremely acute intellectually, and use that ability to the detriment of society. They have been called 'congenital and instinctive criminals'. Most fortunately for society such persons are rare. When this condition of moral and inhibitory defect exists, after a careful inquiry, and after allowing for the effects of bad environment, bad example, and no moral teaching, its subjects may be pronounced quite incurable. Society must forcibly segregate them, as indeed is proposed in the Report of the Commission I have referred to. They usually come of insane ancestry.

Dipsomania, etc.—The most common, and the most troublesome to society, of these uncontrollable impulses and moral defects is that of craving for alcohol, opium, cocaine, and such drugs. They have been called 'dipsomania', 'morphinomania', etc. There are many forms of drunkenness, some of which are curable, but the true dipsomania is, in ninety-nine cases out of a hundred, an incurable malady. It is a real disease. It is often recurrent and periodic in its symptoms, and a careful psychological study of a number of cases has led many physicians, myself among the number, to the conclusion that one usually finds associated with the drink craving more or less of a real mental weakness in character, in intellect, and common sense, as well as will power. The effects of the excessive use of alcohol have been so injurious to society that many Government Commissions have been appointed to investigate the causes and to suggest remedies, while books without number by doctors and laymen have been written on the subject. I was lately a member of a Departmental Committee which investigated the subject of inebriety and its social consequences. We heard many witnesses who had had every sort of social experience. I was greatly impressed with this fact, that the opinion of the public in this matter is now so advanced that we could get no witnesses to contest the thesis that the principle of the liberty of the subject should be set aside when we have to deal with certain forms of inebriety. Even distinguished witnesses from the legal profession, whose duty it is to protect the liberty of the subject, admitted that some statutory provisions must be made to control persons suffering from dipsomania and certain kinds of inebriety. Until the legislature finds time and has inclination to pass such measures, the prognosis of such diseases is mostly hopeless. The exceptions of recovery only prove the rule. Those exceptions, in my experience, apply only to such cases, and they are very few, who lose the drink craving at about the age of thirty or so, from some sort of physiological change which has taken place in their brain action at that time; but even when they recover they are not usually good for much as citizens. I shall speak of the prognosis of alcoholism—an entirely different disease from dipsomania—later on.

The forms which defective inhibition, insane impulse, and explosive conduct may take are innumerable—destructiveness, fire-raising, satyriasis, kleptomania, suicide, homicide, etc. The medico-legal aspect of all these tendencies is extremely important, and we must sometimes be prepared to state on oath in the courts our views of the prognosis in reference to them. Regarding them as a class, the prognosis is unfavourable.

Conditions of Mental Confusion and Stupor.—I have already referred to the stuporose conditions as sometimes forming a part of the sequence of clinical symptoms in melancholia, but there are conditions of stupor and confusion, not associated with melancholia or mania, that form of themselves a symptomatological group of mental disease. A certain amount of confusion may be present in almost any form of insanity, but it may also exist *per se*. Typical cases of stupor are characterized by negative symptoms. There is no exhibition of active mind at all present, there is no mental reflex as the result of

any mental or bodily excitant, and there are many bodily symptoms which show that the higher brain-cells are almost in a condition of suspended function.

There are certain striking bodily symptoms in typical cases of mental stupor which are always of importance in prognosis. The circulation is very disturbed, so that the capillaries have lost their tone, the extremities look blue and feel cold, the whole action of the central nervous system is, to a certain extent, lowered and devitalized, the ordinary motor reflexes are sometimes almost abolished, and the general effect is very alarming to the non-medical mind. The relatives think that a person in such condition is pretty sure to die. The voluntary motor system is found to be in three conditions in different cases: (1) Passive and unresistive ('anergic' stupor); (2) Cataleptic, with a decided tendency to keep fixed attitudes, and the muscles 'waxy'; (3) Resistive, so that a strong resistance is made to change of positions, to walking, etc. Now none of these necessarily means a bad prognosis. They may be all recovered from in time and with proper treatment. Most of the cases of stupor occur before the age of thirty. They are sometimes mixed up with hysterical symptoms. In the cataleptic and non-resistive condition there is no expression of the face or eye whatever. In many of the resistive cases there is a marked melancholic expression. It has been called *melancholia attonita*. While many of the cases result from purely bodily causes of exhaustion, many of them are also the result of terrible mental shocks.

A few of the cases of stupor die, in spite of all treatment, of exhaustion and inanition. As a group, however, they recover in the proportion of 50 per cent, but there is an unfortunate tendency in about 30 per cent to pass into dementia, and those Kraepelin would call *dementia præcox* (see p. 370). Stupor sometimes occurs as a phase in cases of mania or melancholia; and at the end of a prolonged attack of acute mania, in a young person, there may be a stage of stupor which may closely imitate true incurable dementia. One must be careful not to give an unfavourable prognosis in such cases.

Some authors use the term 'primary dementia' to describe certain cases of stupor. I altogether object to the use of the term 'dementia' except to describe incurable conditions of mental enfeeblement. It is also sometimes called 'confusional insanity', but confusion requires to be present in an extreme degree for it to be called stupor, although psychologically and physiologically the two conditions have a close relationship, and the one may be simply an aggravated degree of the other. In some few cases of stupor we may have sudden, automatic, causeless impulses or explosions, like a mental epilepsy. Such symptoms do not necessarily indicate a bad prognosis.

States of Mental Enfeeblement; Dementia.—While the term 'mental enfeeblement' may be used in a semi-popular sense, the term 'dementia' should only be applied to a condition of weakness of mind in regard to memory, power of attention, interest in the outside world, power of reasoning and of emotion, these in by far the larger number of cases occurring as a secondary condition to some more or less acute form of mental disease. Mental exaltations, especially acute mania, are the most common preludes to a condition of dementia; but there are a very few cases where slow, progressive enfeeblement occurs in young people, just as senile dotage slowly draws on as a physiological process. Formerly we were apt to think that the cell damage, caused by toxins, and in acute mania, produced a state of damage in those cells with a tendency to atrophy; but further study of the subject has shown that the primary state of morbid exaltation and the secondary condition of mental deterioration and cell-death are really parts of the same process, and are the result of a possible toxæmia with a strong hereditary tendency towards mental disease. We find that by far the greater number of cases of dementia occur as a sequel to and a part of adolescent insanity, occurring before the age of twenty-five. I have sometimes called it a 'postponed imbecility'.

Unfortunately, in secondary dementia the prognosis is always bad. The patient in fact cannot recover, because 50 per cent of the higher brain-cells in the higher and anterior parts of the cortex have undergone a process of atrophy or degeneration, as can now be demonstrated microscopically. Dements may live for a long time, in the less-marked cases even to an extreme old age; but there is always a tendency for them to be unduly unresistive to the ordinary causes of disease and death. In the older mental hospitals, where there was overcrowding and imperfect ventilation, and where the diet was not as carefully attended to as it is now, 30 per cent used to die of phthisis pulmonalis. In many cases of

secondary dementia the 'stigmata of degeneration', to which I shall presently allude as being present in congenital enfeeblement, are found.

Conditions of Congenital Mental Weakness; Amentia.—In the process of growth and development of the brain there is liable to occur an arrest, either in utero, or in the first five years of life. This results in a mental enfeeblement, an incapacity for education, and most frequently also in changes in the normal appearance, strength, and power of the body generally, or in some of its chief organs. Of recent years these conditions have attracted great social attention, and have been subject to an inquiry by a Royal Commission, as previously stated. By scientific observers, conditions of idiocy and congenital mental defect have been classified in various elaborate ways, etiologically, symptomatologically, and pathologically. Several observers, especially of the Italian school, have been inclined to put down a considerable proportion of them to ante-natal toxic conditions. This, though undoubtedly applying to some of them, has not yet been proved to be the cause in by far the majority of cases. The Royal Commission to which I have referred classified these patients as:—

1. *Idiots*, i.e., persons so deeply defective in mind from birth, or from an early age, that they are unable to guard themselves from common physical dangers, such as, in the case of young children, would prevent their parents from leaving them alone.

2. *Imbeciles*, i.e., persons who are capable of guarding themselves from common physical dangers, but who are incapable of earning their own living by reason of mental defect existing from birth, or from an early age.

3. *Feeble-minded*, i.e., persons who may be capable of earning a living under favourable circumstances, but are incapable, from mental defect existing from birth or from an early age, (a) of competing on equal terms with their normal fellows, or (b) of managing themselves and their affairs with ordinary prudence.

They add a fourth class, *moral imbeciles*, the class of which I have already spoken.

This classification is, as will be readily seen, largely founded on administrative grounds, for the purpose of enabling the legislature to adopt different measures and to provide different kinds of institutions for these classes of defectives.

Looking at the whole class from a prognostic point of view, it may be said that they are all incurable. Idiocy is not only incurable, but is only improvable to a limited extent, in regard to the habits and ways of the patients, by placing them in institutions and by special treatment. Their lives may thus be rendered somewhat more human than if left alone, and undoubtedly may be prolonged. As showing the fact that, in this condition, not only the brain and mind are defective, but the whole nutrition of the body is weakened, it is found that about two-thirds of all the idiots are subject to, or die of, tuberculous disease. The second class, the 'imbeciles', are educable, in special institutions and by special means, to a considerable extent; but there is a limit to this, and all their lives they will require to be cared for by others. It is now proposed to provide special institutions for such care at the public expense, as a great philanthropic measure, for all of them who have not means to provide it for themselves. Undoubtedly the imbecile may be enabled to lead a happier life and to live longer through such special care. The third class, of the 'feeble-minded', often called 'defectives', have attracted more public interest than the other two classes, because they are nearer ordinary humanity, and some of them exhibit special capacities, e.g., in music and mechanical work, etc., in a stronger degree than even average humanity. There is a great social and eugenic question connected with this class also, namely, the risk of their propagation, the liability of some of the female defectives to fall into the ranks of prostitution, and other social and moral risks to which society is liable through their existence. The educability of many of them, during childhood and youth, is such that a few may be made self-supporting members of society, but always need some supervision. None of them can ever attain the position of a responsible citizen. The whole question of prognosis is mixed up, in conditions of congenital enfeeblement, with legislative, social, and educative measures on their special behalf, and improvement can only be attained at the best in the great majority of cases. The few cases which are really restored to mental capacity are those resulting from gross pathological conditions, capable of recovery and cure, like hydrocephalus and traumatic injury to the brain.

Stigmata of Degeneration.—There are certain kinds of bodily and mental abnormalities that are found in most congenital cases, which are of importance, both in diagnosis

and in prognosis. These have been called 'stigmata of degeneration'. They assume innumerable forms. The bones of the head may be so altered that they make it abnormal in shape, and so alter the expression of face, producing the effect of 'ugliness'. Malformations of the hard palate are the most frequent of all the bodily stigmata. It may have a 'V' shape or a saddle shape, or it may be cleft. The teeth may alter in their number or shape or disposition; the bones of the thorax may be affected so that we have pigeon-breast. The fingers may be short or irregular; the hand may be of that shape that we now call 'neurotic'. There may be supernumerary fingers or toes, or club-feet. The organs of special sense, especially the eyes and the external ear, may be abnormal; asymmetry or attached lobes occur. The angle of the eyelids may droop so as to produce a Mongolian appearance. The heart, the stomach, the bowels, the tongue, the genito-urinary system, may be all abnormal. There may be a general arrest of bodily function producing 'infantilism' and dwarfishness. The general power of expressing emotion in the face may fail. Certain mental stigmata also are liable to appear. Arrested, or postponed, or unrelational development of the mental faculties is common. Speech may be defective or postponed in coming on. The power of reasoning may not be absent, but so disturbed that the victims are never able to draw right conclusions from premisses, however obvious they may be. There are cases where the memory is so prodigious that whole pages of a book can be repeated after once reading it. Many cases of an abnormal power of calculation are on record. All these things give a bad prognosis in any case. They are found, but not so frequently, in some cases of adolescent insanity, and are extremely common among developmental epileptics.

Cretinism—Thyroid.—There is one class of imbecile children where the prognosis is not always unfavourable, viz., the cretins, and those in whom the thyroid gland is affected in its functions. Many of these are either cured or markedly benefited by the administration of thyroid gland. Many physicians now try thyroid administration experimentally whenever they have an idiot or imbecile to treat, and occasionally great improvement is thus attained.

General Paralysis.—We now come to one of the most interesting of all forms of combined brain and mental disease—general paralysis. Its prognosis has this profound interest, that while as yet there is an almost infinitesimal record of recovery, there is a strong feeling, founded on the facts of its etiology and of the results of recent developments in vaccine and other treatment, that its cure will become possible when our knowledge in regard to it still further increases, and that it may be prevented by an early cure of all cases of syphilis.

The chief difficulty in this disease is not its prognosis, but its correct diagnosis in the early stages. In addition to the well-known clinical symptoms of the disease, the Wassermann reaction has now taken a definite place as perhaps the most important of all in confirmation of the diagnosis. The disease may now be said, almost definitely, to have syphilis as its predisposing cause. Whether there is not another and proximate cause in syphilized subjects to account for the disease is as yet in doubt. Considering that it only occurs in from 2 to 4 per cent of those who have acquired syphilis, and that it is not amenable to antisypilitic remedies, it seems to me that there must be another etiological element, probably in the shape of some specific micro-organism. Dr. Ford Robertson, who has worked long and arduously at this subject, is of this opinion, and he believed, at one time, that a form of diphtheroid organism, which he called the *Bacillus paralyticans*, was the proximate cause of the disease; but this has not as yet been confirmed. He has certainly been able to produce a morbid condition of the brain in some of the lower animals which, in symptoms and pathological appearance, closely resembles the disease, by using injections of cultivations of bacilli from general paralytic patients.

The duration of general paralysis, from its beginning, varies from a few months to over twenty years, but the average duration of life is a little under three years. One of the great things to remember in general paralysis is that no prognosis is justifiable until the disease has been definitely ascertained to exist. Further, there must be a combination of mental and bodily symptoms present. Certain mental and bodily conditions closely resembling general paralysis, produced by alcohol, syphilis, epilepsy, trauma, organic brain disease, acute mania, and chorea, must be eliminated before any diagnosis or prognosis is come to.

There are certain symptoms which at present usually mean a short duration of the disease. These are extreme acuteness of symptoms at the onset, congestive attacks, and rapid development of the three stages one after the other. There are other symptoms which indicate that the case will probably last long. These are a slow, insidious onset of mental enfeeblement, freedom from maniacal symptoms with ambitious delusions, the prolongation of the first stage, and the occurrence of what appear to be remissions in the course of the disease.

We now recognize that, in addition to the classical three stages of the disease, there is a preliminary or prodromal stage; but the symptoms of this are as yet so uncertain that we must on no account give a bad prognosis because of any such apparent prodromal symptoms. The application of the Wassermann test will, however, in the future help us greatly in regard to the prognosis by determining the character of such preliminary stages. The great hope for the future in regard to general paralysis is that it will be altogether prevented by the early cure of syphilis in all cases.

Syphilitic Mental Symptoms.—There are conditions of mental disease due to the direct action of syphilis on the brain, its neuroglia, its membranes, or its vessels, apart from general paralysis. The prognosis, in many of such cases, is exceedingly good, if treated in time. It is in these cases, rather than in general paralysis, that salvarsan comes in as a mode of treatment, and the Wassermann reaction as a means of diagnosis. If mental symptoms occur during the second stage of the disease, they are, in nearly all cases, curable under the proper treatment of the disease. These secondary mental symptoms are, however, very rare. The most common form of syphilitic insanity is caused by various forms of vascular disease. These may occur in any degree. Sometimes they are extremely localized. Usually they are slow in their course. They are very difficult to diagnose during the first stage, which is undoubtedly the most curable. If we have marked motor paralysis, indicating serious damage to the motor centres, the symptoms may be arrested, but we can seldom hope for cure. In such cases I have frequently known the patient recover in regard to his mental condition, but still remain more or less paralytic, and live for many years. The occurrence of convulsions, which usually take the form of Jacksonian epilepsy, does not necessarily indicate a bad prognosis if proper treatment is adopted. I can recall a case where, as a young man, the patient had both slight local paralysis and Jacksonian epilepsy, but he lived for fifty years and did good work during most of that time. There was no progression of the symptoms in his case.

There is a form of what I believe to be syphilitic insanity which has, at first and often for many years, no bodily symptoms except hallucinations of hearing, the mental symptoms being morbid suspicions and tendencies to impulsive violence. If such cases are diagnosed and treated by antisiphilitic measures very early, I have seen recovery take place; but if really established, the outlook is very hopeless; it becomes an ordinary case of delusional insanity. Such cases usually have a bad heredity, and the syphilitic brain poisoning seems to light up this heredity into actual mental disease, just as an excessive use of alcohol might have done, without causing very marked damage that can be detected microscopically after death.

We see a few cases of acute mental disease resulting from syphilitic meningitis, from gummata causing pressure, taking the form of local convulsions and acute mania. This, if detected early enough, is amenable to treatment by the iodides in very large doses. The risk of death is, however, very great.

The actual number of cases of syphilitic mental disease is very small, in my experience being only 0.5 per cent out of 3145 cases of mental disease altogether. No doubt in minor forms, treated and cured outside institutions, it is much more common; and with the Wassermann reaction and the use of salvarsan, we should expect syphilis to be much more curable and free from mental complications.

ALCOHOLISM AND ALCOHOLIC MENTAL DISEASE.

The excessive use of alcohol is statistically the most frequent cause of mental disease in this country. Its incidence ranges between 6 and 25 per cent of the cases sent to institutions. It acts both as a predisposing and exciting or proximate cause in different cases. Alcoholic mental disease takes very different forms in different cases, according to the kinds of alcoholic liquor used and the way in which it has been taken. Its prognosis may

in different cases be absolutely bad or in the highest degree favourable. Its forms and characters range from acute delirium tremens to complete dementia, from cases where its bodily symptoms are the most important, to others where there are scarcely any bodily symptoms present at all. It is therefore necessary, in considering its prognosis, to take its forms into account. I find that out of the 11,346 cases (5540 men and 5806 women) of mental disease sent to the Royal Edinburgh Asylum in the thirty years 1874–1903, there were 1644 cases diagnosed as the insanity of alcoholism, a percentage of 14·5; the percentage of alcoholics among the men was 18·5 per cent, and among the women 12·9 per cent.

Delirium Tremens, if caused by the stronger liquors, recovers in at least 80 per cent of the cases, 10 per cent dying, and other 10 per cent passing into the more prolonged insanities with hallucinations and a doubtful chance of recovery.

It is now stated by recent authors on alcoholism, like Dr. Hare, that delirium tremens should be preventable altogether if proper measures are taken when it is threatened or when its symptoms first appear. Hare calls delirium tremens an ‘abstinence symptom’, and he believes Janregg’s theory that the real cause is a hypothetical substance called an ‘anti-alcohol’. He strongly advocates its abortive treatment. This is carried out by not depriving the patient of alcohol suddenly, and giving it either by the stomach or by inhalation with oxygen, carrying out this treatment with ‘adequate’ quantities until the patient begins to improve. He states that not only is the disease better treated, if ‘aborted’ in this way, but the risk of death is less, and the risk of such complications as pneumonia is much lessened. I should like to see the term delirium tremens abolished and ‘acute alcoholism’ substituted for it. Patients not only recover from this disease but, Hare says, there is little risk of relapse, unless alcohol is again taken to, which, most unfortunately, is very apt to be the case. When the temperature falls, and the power of sleep is restored, the patient may be pronounced on the way to convalescence.

Mania a Potu.—This is really a transitory alcoholic delirium to which patients of a certain neurotic type of brain are subject from a bout of drinking, or, in some cases, from even small quantities of alcohol. It does not imply previous alcoholic habit, and its symptoms almost invariably pass off in a few days. Its occurrence means that the patient subject to it should never taste alcohol in any shape or form.

Chronic Alcoholism.—When we pass from these two forms of alcoholic mental disturbance to chronic alcoholism, the question of prognosis worsens in a very marked degree. While chronic alcoholism varies in most of its symptoms, according to the constitution of the patient, to the time during which excessive alcohol has been taken, and to the kind of liquor used, it invariably has symptoms, bodily and mental, of a much graver nature, and in most of the cases there are, after death, demonstrable changes in the brain cells, their vessels, neuroglia, or envelopes. In most cases there are motor symptoms, these taking in some cases the form of general convulsions, in others tremulousness, sensory symptoms, slow motor paralysis, or muscular inco-ordination. The working of the mind-muscles in the face, as shown by the facial and eye expression, is invariably deteriorated in chronic alcoholism. Mentally, the patients have either morbid suspicions and fears, or hallucinations of hearing. There is always also moral deterioration, loss of self-respect, and of truthfulness and of feelings of honour. The memory for recent events is, in the more chronic cases, impaired. There is often insomnia, the speech is often blurred, inco-ordinated, or thick. The spinal reflexes are often abolished. There is sometimes peripheral neuritis. The patients have always lost some of their inhibitory power, and in some cases there are tendencies both to suicide and homicide as well as to other morbidly impulsive acts.

As to the prognosis of chronic alcoholism, it is, in most cases, bad, on account of the organic lesions of the brain to which I have referred, and the fixed and strong habit of excessive use of drink; but in my experience a certain number of the cases, with even marked symptoms, get better if properly treated. The length of time the patient has drunk excessively, and the duration of marked mental symptoms, are the two circumstances on which prognosis must chiefly depend. If the patient has been a chronic drunkard for many years, and if the mental symptoms are comparatively recent, and have in them some of the characters of acute alcoholism, then the prognosis may not be absolutely bad. I have seen some, even unfavourable, cases improve so much under the

use of iodide treatment that they were no longer technically insane; but in most of the cases who thus improve, a careful psychological analysis of the patient's mental and moral faculties, and especially of his power of mental inhibition, will show that there is some deterioration as compared with his normal condition. There are a few cases in which, when the chief symptoms of chronic alcoholism have disappeared, there also disappears the craving for drink; but I think this results more from a certain lowering of nervous and mental action than from a recovery in self-control. Complete recovery is usually a long process when it occurs.

Alcoholic Dementia and Degeneration.—Patients who have taken alcohol in excess for many years are liable to a general lowering of the mental condition, to a diminished power of initiative and action, and especially to defects of memory that are very characteristic. The expression of the face and eyes are altered and deteriorated, and the man is not at all 'the same' as he was. There need not have existed, in such cases, any previous form of acute alcoholism or insanity. I need hardly say that this condition is entirely hopeless in regard to the prognosis, and the older the man is, the worse the outlook. Such a condition seems to bring on senile dotage prematurely. The brain-cells are hopelessly degenerated.

'Respectable' Excess.—To anyone who is accustomed to observe carefully the expression of face and the intimate psychology of some of his friends and acquaintances who take much liquor, there are minor mental degenerations to be seen, as the result, not of constant drunkenness, but of what has been really excess in the habitual use of alcohol, though it may not have been counted very unusual. They were 'respectable' drinkers. The finer traits of mind and character get lost. There is a coarsening of the moral tone, a lack of energy and activity in life; selfishness and egoism are seen in too marked a degree. Now, in the very beginning of this condition, if a man has judicious friends and a firm doctor, so that he is persuaded to abandon entirely the use of alcohol, to take a great deal of exercise, and resort to outdoor games, these suspicious symptoms may entirely disappear and the man may become his old self. I have seen many such cases.

I have already treated of *dipsomania* as one of the forms of defective inhibition.

Morbid Cravings for Various Drugs.—Opium, chloral, cocaine, and various other drugs of the nerve-stimulant or nerve-sedative type may be taken to such excess that they become a morbid habit and virtually forms of mental disease. It may be said that in regard to most of them the habit may be broken and the patient cured for the time being, but only through outside control and special treatment. The patients are not able, of their own accord, to cure themselves and abandon these drugs. The opium habit is the most common, and if long continued is more liable to end in death than any other, through stomach irritation and incapacity to receive food. My experience, however, is that the cocaine habit is really the most difficult to break, and the most apt to return. Cocaine is, in fact, the most fascinating and the most powerful destroyer of human inhibition of any substance known to us. I have seen a complete cure of the opium habit after thirty years' duration. I have never seen a cure of the cocaine habit at all. Special institution treatment is necessary in by far the majority of cases of the drug habit, though, where the means allow, a doctor's house or a home with special nursing may be effectual.

The prognosis in the opium habit depends on (1) The patient's resolution to undergo treatment; (2) His response to treatment in its early stages. During the gradual tapering down of the drug, which is the method now always practised, there is intense misery and prostration. If the sickness, diarrhoea, and consequent exhaustion are extreme, the patient may die, or the treatment may even, in a few cases, have to be stopped to save his life. (*See also DRUG HABITS.*)

THE MENTAL SYMPTOMS OF ORGANIC BRAIN DISEASES.

Attacks of apoplexy or hemiplegia, especially those in advanced life, are almost invariably accompanied by mental symptoms. The same thing occurs as the result of tumours, atrophies, and many gross forms of brain degeneration. These symptoms sometimes take the form of morbid excitement, but in essence they are an enfeeblement of mind. We find, in a large number of such cases, an emotionalism, a childishness, a morbid suspiciousness, a loss of will power, a diminished power of work, and a lessened mental energy. These symptoms do not, in most cases, constitute an insanity in the

popular sense. The mental symptoms are apt to be more acute in the early stages of most organic diseases, and more those of enfeeblement in the later stages, especially in paralysis with softening of the brain. If we have an embolism of one of the smaller brain arteries in a young person, it may produce local paralysis almost without any mental symptoms after the first few weeks, and the same is seen in syphilitic vascular disease. Taking the statistics of the Royal Edinburgh Mental Hospital for the nine years 1874-1882, we had, out of 3145 admissions, 91, or 3 per cent, of this kind of mental disease, which means that the mental symptoms in these were of a marked type. Of these 91 cases, 17, or almost 19 per cent, recovered. I do not say that all the recoveries were so perfect that the subjects of them were not handicapped in some way, but this favourable result, I confess, surprised me. I had expected a considerably less 'recovery' rate. The treatment really consists in proper nursing and non-stimulating diet, and if the patient improves within the first month his chances of at least a partial mental recovery are good, but it will probably be slow. The patient's age is perhaps the most important thing in forming the prognosis. If his age is great and there are signs of arterial degeneration, it is bad.

EPILEPTIC UNSOUNDNESS OF MIND.

A study of the manifestations of epilepsy unfortunately shows it to be associated with mental disturbances or mental defect in a very large proportion of cases. Those disturbances and defects assume a great variety of forms, and their degrees and intensity are strikingly different. For prognostic purposes we have to divide epileptic unsoundness into three groups: (1) Mental defect as an almost universal accompaniment of the disease when it occurs before seven years of age; (2) Mental defects and disturbances when they arise during the developmental period between seven and twenty-five years of age, the largest number of cases occurring during this period, and the most typical mental effects being then seen; (3) Epilepsy occurring in the fully-developed and senile periods.

The defects in the first period are those of mental deficiency from a retarded development of the brain, and the prognosis is the same as in idiocy and imbecility. It may be said to be hopeless if the fits are frequent and regular in course, but there are a few cases of convulsions of the infrequent and sporadic character, at that period of life, in which the brain and mental development is not very seriously arrested or retarded. The epilepsy of this period of life is, in most cases, accompanied by such abnormalities and stigmata as I have described in idiocy. We look on the mental defects, the bodily stigmata, and the fits, as being all effects of the common factor of arrest in brain growth and development. As a matter of fact, however, the occurrence of epilepsy is a very unfavourable factor as regards educability and improvement in the mental condition, either when carried out in the form of special training in institutions or at home. Any improvement thus produced is apt to be arrested and put back by the frequent occurrence of the fits.

The second form of epilepsy may be consistent with technical soundness of mind between the fits, especially during the earlier part of the disease; but the general tendency is towards mental deterioration when it is long continued, and there is always a danger of conditions of mania occurring, often of a very severe type, and of delusional conditions connected with the fits. The prognosis is not absolutely bad, for men and women are met with who have occasional sporadic fits during many years, or during the whole life-time, without the occurrence of technical insanity or even marked mental deterioration. Efficient work in life may be done in these cases; but a careful observation of the character and whole life-history of the epileptic who is reckoned sane, is apt to result in the conclusion that even in them there are apt to be slight abnormalities in the emotions and character. The occurrence of epileptic fits at very rare intervals may, however, be compatible with great mental power, and even with genius. It is usually said, but the statement lacks definite scientific proof, that Julius Cæsar, Mahomet, and Napoleon were subject to such attacks.

The mental symptoms in ordinary epilepsy usually occur after one or more fits. In such cases, the symptoms are acute and are often very violent, sometimes with attempts at homicide. The epileptic maniac is an extremely dangerous man. These acute mental symptoms commonly occur within twenty-four hours of the convulsions. There are many

epileptics who are subject to mental disturbances as a prelude to the fits. These show themselves a day or two before the convulsions occur, and, in many cases, the mental symptoms cease apparently as the result of the fit. There are a few cases where a mental disturbance will, as it were, take the place of the fits; this is the mental epilepsy, the false consciousness, the *épilepsie larvée* of the French. If epilepsy persists year by year there is almost always a mental deterioration, a loss of memory, a change of affection, a blunting of the finer feelings, a morbid egoism and selfishness, all these symptoms getting worse as time goes on. This is, in fact, an epileptic dementia. The prognosis in this second class of epileptics is extremely bad in regard to complete recovery. Attention to the health and diet, abstinence from alcohol, a routine life of work in the fresh air, and a steady use of the bromides in suitable cases, will undoubtedly in most cases result in a diminution in the number of attacks and in an enormous modification for the better of the acuter mental symptoms. I used to have, in the Royal Edinburgh Asylum, a steady average of thirteen epileptics sent to the institution every year, and about forty constant residents, and after I put the greater number of them on constant doses of from 25 to 50 gr. of bromide of potassium every twenty-four hours, the acuter forms of epileptic mania practically ceased, and I was able in ten years, out of 115 admissions, to discharge 22, or 19 per cent, as 'recovered' mentally. This gives, however, too favourable a prognostic result, because, if the patient who has been certified as insane in an institution remains mentally free from technical insanity for twelve months, although he is still an epileptic and subject to mental attacks, we must legally discharge him as recovered from his mental disease, and many of the recoveries were contingent on patients regularly using the bromides, which, by the way, it is extremely difficult to get carried out when a patient feels himself pretty well and does not have the fits for a certain time. Statistics show that 51 per cent of all epilepsy comes on before fourteen years of age, and 95 per cent before twenty-five. This fact clearly shows its definite relationship to the early period of life and brain development. The Royal Commission to which I have alluded gives some statistics in regard to epilepsy. It quotes one estimate as being one sane epileptic per thousand of the population. This would make the number in the country 45,216, but another investigator gives the number as only 19,516 for England and Wales. Such a discrepancy shows that these estimates are unreliable. The estimate of the Commissioners in regard to insane epileptics in asylums and workhouses, or in the general population, is that their number amounts to one in ten thousand, or 4521. As an actual matter of fact there are 11,078 epileptics out of an insane population in the county and borough asylums of England. My estimate is that there are 100,000 epileptics, sane and insane, in Great Britain and Ireland. The prevalence of epilepsy in different counties and districts of England differs enormously. It may be said that in those agricultural counties of England which are largely beer- or cider-drinking, the proportion of epileptics in the mental hospitals is much greater than in the manufacturing counties and large cities, and amounts to 11 per cent of all the admissions to county asylums. In the large cities of England they amount to 8 per cent, and in Scotland to about 4 per cent of the admissions.

It is a curious fact, as illustrating the possibility of treating epileptics and epileptic insanity at home and in private houses, where there are sufficient means, that the proportion of epileptics among private patients in mental hospitals is enormously less than among the rate-paid class of insane.

In regard to the third class of epileptic insane, where the disease has come on after twenty-five years of age, which amounts to 5 per cent of the total number, it is, to a large extent, the result of excessive alcohol or traumatism or vascular disease in old age. The prognosis in many such cases is more favourable than in the cases that have occurred before twenty-five. I have no actual statistics, but I would give it at about 30 per cent if treatment has been begun at once.

In dealing with the prognosis of epileptic mental disease, one must not leave out of account the fact that most epileptics are exceedingly apt to have an uncontrollable craving for alcohol, and that, under the influence of alcohol, they become far more dangerous and homicidal. It is well known that, of the number of homicides committed in the country, a certain proportion of the murderers are epileptics. Any medical man having an epileptic to treat should certainly point out this possible danger in every case.

MENTAL DISEASES ASSOCIATED WITH CHILDBIRTH.

The mental affections connected with childbirth have been naturally assorted into those which are liable to occur during pregnancy; those which occur soon after, and as the result of, confinement; and those that occur during nursing.

Puerperal Insanity.—By far the most important and the most frequent of these is puerperal insanity, which term is somewhat artificially restricted to apply to cases occurring within the first six weeks after delivery. This does not present the same symptoms in all the cases; but the larger number and, as it were, the general type, consists of those occurring within the first fortnight after delivery. This type is about the acutest form of mental disease ever met with, and the most deadly, always excepting general paralysis. The temperature is high, rising sometimes to 106° . The pulse is extremely weak and thready, the patient looks extremely exhausted, the lochia cease, the mucous membranes are apt to be dry, the eyes are brilliant, and the bodily condition is one of great exhaustion and obvious risk. The mental symptoms are of the acutest type. The attention cannot be fixed, the patient is in a condition approaching delirium. She takes no notice of, and has no interest in, her baby; she gets violent and may have to be held in bed; she will not take food; and, above all, we have the gravest symptom that can occur in mental disease, she may try to injure her baby or put an end to her own life. Now this condition resembles a toxæmia so closely that it is difficult to believe it is not of that character; but no specific organism has been yet detected, though diphtheroid and other micro-organisms have been found, especially in the urine; some recent authors deny its toxic character. Looking at it from a clinical point of view, such acute cases certainly seem the result of some toxic poison. Their prognosis in regard to recovery is extremely good. They not only recover quickly, most of them within three months, but the recovery is a complete one, not subject to relapse. But there is one distinct risk in such acute cases, and that is of death, especially when the temperature goes much above 102° . The death-rate in these amounts to over 10 per cent. My experience is that *the* test of the risk of death is found in the temperature above all other symptoms.

I have found that over 80 per cent of such acute cases recover. They are subject to intercurrent diseases—septic inflammation of the womb and its surroundings, meningeal inflammation, and, incidentally, mammary abscess. As might have been expected, heredity comes in as a predisposing cause of mental disease after confinement, as it does in most other cases.

There is a type of puerperal mental disease of a milder type than that which I have described, constituting about one-half of the cases. In these, the symptoms are all milder, without much tendency to an abnormally high temperature, and with the risk of death greatly diminished. These recover in the proportion of about 70 per cent, some of them running on into chronic insanity and dementia. They do not recover quite so quickly as the very acute cases of the disease, taking sometimes six months to get better; but in the milder, as in the acuter cases, the risk of the mother injuring the child has to be kept in mind in every case, and the nurses and relations must be seriously warned on that point.

Lactational Insanity.—When a woman, in addition to having a child, fulfils the natural duty of nursing it, and she is perhaps not strong in general health, and is in poor circumstances implying hard work and insufficient nourishment, she may, if there is any innate liability to the neuroses or to insanity, become affected in mind during such nursing. We call this 'lactational insanity'. It is apt to be an anæmic disease attended by exhaustion of body and depression of mind. The mental symptoms are usually preceded by headaches, flashes of light, feelings of exhaustion, and irritability. If these are seen and treated in time, the chances are that no mental symptoms will supervene. When they do appear, the risk of suicide should be kept in mind. In some cases the symptoms are those of mania. My experience is that over 77 per cent of the lactational cases recover, but the recovery takes a longer time than in the puerperal cases, for the general strength has run down to a greater degree. Lactational insanity seldom occurs among the better-off classes, the reason being, no doubt, that they have proper nourishment and are not being over-worked while they are nursing their children. With proper nursing and good food we should not lose a lactational case. Most of them respond to such treatment at once.

The Mental Disturbances of Pregnancy.—This is a rare form of mental disease. The symptoms are usually mild depression, but there is always a risk of this depression leading to suicide. Most cases of the mental disease of pregnancy have a bad neurotic heredity. The worst class of cases, those sent to mental hospitals, only recover in the proportion of 60 per cent, and of those who do not recover, a large number pass rapidly into dementia. Women are more liable to have mental symptoms during the first than subsequent pregnancies, especially if they are over thirty-five. As a question of prognosis, the treatment of serious mental symptoms occurring during early pregnancy by abortion or premature labour is now a measure to be seriously faced by the medical man. For myself, I am of opinion that this should be done, after consulting with another medical man, and with the full written consent of the husband or nearest relation. It gives a better chance to the mother, which is the first consideration, and it prevents the entrance into the world of a human being who would be extremely liable to be mentally affected. Dr. Routh describes the 'toxæmias of pregnancy'; no doubt these, in predisposed subjects, account for some of the insanities.

The mental disturbances connected with childbirth occur in the proportion of 5 per cent puerperal, 4 per cent lactational, and 1 per cent pregnancy, in Edinburgh. In Cumberland and Westmorland my experience for the ten years 1863–73 was that they occurred in the proportion of $17\frac{1}{2}$ per cent of all the female cases. When they recover they remain well mentally with very small chance of relapse, except in those who have subsequent childbirths.

THE EPOCHAL MENTAL DISTURBANCES.

In addition to the mental disorders of which I have spoken connected with childbirth, certain other epochs of life are subject to mental disturbances of a somewhat characteristic kind, with many distinctive symptoms and marked differences in their prognosis. In the ordinary man and woman, with a reasonably good heredity, the various eras and epochs of life are passed through without much risk of mental upset. It is different with those of the neurotic and psychopathic constitution. The physiological characteristics are, in them, more liable to pass into pathological states. Each era of life has its own normal psychology, and the passing from one into the other may quite naturally be expected to have some influence on the mental working. The epochal psychoses will always be co-related with the epochal neuroses by the thoughtful physician, and we know that the 'critical' periods of life are often attended with nervous as well as mental symptoms.

Childhood, Boyhood, and Girlhood.—This era has a singularly characteristic psychology, and is very free from such mental disturbances as can be rightly called insanity. When such disturbances are seen, they usually take the form of short attacks of maniacal elevation resembling delirium, which soon pass off, but may recur a few times before final recovery. A very few indeed have attacks of depression of mind which are apt to be recurrent. There are some children, always those of the neurotic diathesis, who, whenever they become feverish from any cause, are extremely liable to become delirious. Even temperatures under 100° may cause severe delirium in them. It may be said that the mental disturbances of children, except those in the very early periods of life which are either syphilitic or of the nature of idiocy and other mental arrestments, are curable, and are speedily recovered from. Left to nature, or with the use of mild sedatives such as the bromide of ammonium, they speedily return to their normal state.

Puberty and Adolescent Mental Disturbances.—The great physiological and mental changes that take place at puberty and go on for ten years through the period of adolescence, are attended with more serious mental and nervous risks than any of the epochs of life except childbirth. It is unfortunately true that the prognosis is very serious in many of these cases. At least 30 per cent of the mental cases ultimately fall into that state of mental deterioration and death which I have described under dementia and dementia præcox.

The chief and the most characteristic phases of the mental disturbances at puberty, and more especially during adolescence, are a tendency to attacks of maniacal excitement, often very acute in character, each individual attack not lasting long, and when it abates recovery seeming to have taken place. But these attacks have a tendency to return,

often many times; in fact, adolescent insanity, as I have called it, is especially a periodic and recurrent form. In forming a prognosis of this form of mental disturbance it is, in the first place, necessary to observe whether the patient is averagely developed and has no bodily stigmata of degeneration. These, unquestionably, may be bad signs in regard to recovery. If, in addition, he has been somewhat backward in mental development or prone to undue excitability, or has shown defects in morals and character in a marked degree, if he has been 'thoughtless' and not very educable, then the outlook is not very good, but not necessarily very bad. Even cases with such characters recover in many instances. If, on the contrary, he has been well developed and normal up to the time of the attack, in body and mind, if the attack has been of manic-depressive character, and if, after the first, we notice that the subsequent attacks are less acute and shorter in duration, we are entitled to form a favourable prognosis. As a matter of fact, mental disease of marked character does not occur so frequently until a later period of adolescence, namely from seventeen to twenty-five. I have always held and thought that the liability to such attacks was coincident, in persons with a bad heredity, with, not the actual gain in weight of the brain, which has virtually ceased before that time, but with its development in its highest function of mentalization. One need not be a physiologist or a psychologist to realize how momentous, during this time of life, are the subtle changes in brain working which mean full reasoning power, large powers of self-control and moral feeling, development in a normal form of the religious instincts, proper regulation of sex feelings, appreciation of the higher forms of literature, and manliness and womanliness of the best type. All these have not usually come to perfection at the age of seventeen; they have, or should have, by twenty-five. A moment's consideration shows that in the formation of the brain vehicle for these qualities, so momentous to a successful life, a certain strain is put on the organ and its higher cells. Now the period of this strain is the period of liability to adolescent insanity. If we closely notice the bodily developments at this time of life, we see marked changes in the direction of attaining the mental and bodily ideals of man and woman. The man's form takes on a manly type, the beard grows, and the voice completes the change that has begun at puberty. In the woman, the form rounds up towards the ideal type of beauty, the mammæ develop, and the whole woman is perfected. Now, if we find those changes taking place normally during the time that a patient is subject to these recurrent attacks of mental excitement, then we form a favourable prognosis. Nature has in such adolescents gone through the strain laid on her, and there is a reasonable probability that the tendency to mental disturbance has passed, at all events until child-bearing or the climacteric occurs.

In a certain proportion of the cases of adolescent mental disturbance (about 22 per cent) this takes the form of depression, which is so apt to abate and recur, though not quite in the same degree as in the acutely excited cases. The prognosis in the melancholic cases is better than in those of mania. Taking the whole of the mental disturbances of adolescence into account, they recover at the rate of 60 per cent; limiting oneself to the depressed cases, the rate of recovery is about 10 per cent more.

Instead of exaltation or depression, we may meet with stuporose, confusional, and lethargic symptoms, sometimes, too, with catalepsy and 'trance'. The prognosis is not so good in such patients, but is by no means very bad.

The worst class of symptoms in regard to prognosis are those which Kraepelin selects as constituting his dementia præcox, of which I shall speak presently. I had always held that the man who could tell us in the early stages of any case of adolescent insanity the symptoms which indicated incurability, would add greatly to our exact knowledge of psychiatry, and I welcomed Kraepelin's induction accordingly.

There is an undoubted liability to a recurrence of mental disturbance in those who have had an attack at adolescence and have recovered. Tracing them through their whole lives, I find that nearly 20 per cent are liable to a recurrence in some form or other.

The gravest aspect of adolescent insanity is that, in about one-third of the cases, instead of recovering, they pass slowly into dementia. Nature has not been able to bear the strain of the period of complete development, and the young man or woman virtually dies as regards all the highest qualities of mind. I believe that, in most of these, dementia is inevitable from the beginning. No methods of prophylaxis or treatment

would have had much effect in saving their mental life. It is this that makes me look on them as having some analogy to the cases of congenital imbecility, in which a mental death has taken place in the earliest periods of life. The brain of the imbecile has been 'unfit' from the beginning; the brain of the adolescent was fit up to twenty, and then became unfit from some deeply-seated hereditary cause.

In addition to imbecility and adolescent insanity, we notice during brain development a series of lesser mental and moral changes, states of perverse conduct and peculiarities, which are due to the same hereditary defects, and are, in many ways, of the same essential nature as technical mental disease. These frequently occur at earlier ages than adolescent insanity, sometimes even before puberty. They consist, in some cases, of stupidity and lethargy, in others of perversions of the social instincts, in others of causeless aversions to father, mother, or other near relations. Some show their peculiarities in an abnormal intolerance of control, incompatibility of temper, and, in some, in immoralities and criminal acts. It is a striking fact that one-half of all convictions for crime are found in offenders under the age of twenty-five. There are many cases of the morbid impulsiveness, the losses of control, and the tendencies to drink which I have described, that occur at that age. Most of such cases are ascribed simply to bad conduct, which the parent and the schoolmaster usually treat by punishments. A few of such cases recover from these mental and moral peculiarities towards the end of adolescence, but unfortunately the outlook is bad in most of them, and they remain, so long as they live, the bad citizens, the skeletons in families, and the criminals of society.

Dementia Præcox.—Since I first segregated those forms of insanity just described and called them 'adolescent insanity', Kraepelin, of Munich, has segregated a group of mental cases occurring about the same age which he has called 'dementia præcox', and holds they form a distinct variety of mental disease, with distinctive symptoms and history. That term covers the unfavourable region of adolescent insanity. Those who recover, Kraepelin would include in his 'manic-depressive insanity'. The chief features of dementia præcox are that it begins slowly over a period of years, and the patient shows his disorder more by what he does than by what he says and thinks. He shows odd or bizarre conduct. The emotional tone is blunted and changed. There is a peculiar loss of consistency between ideation, emotion, and will. The will power is perverted or lost, the conduct is automatic, there are what is called negativism, 'stereotypism', apathy, mannerisms, and indifference to personal appearance. The patient often has hallucinations, and is completely changed in character. Kraepelin divides the cases into three forms: (1) 'Katatonic', (2) 'Hebephrenic', and (3) 'Paranoid'. All three varieties are unfavourable as to prognosis, but the first and second are better in this respect than the third. Many of the katatonic are those which I have described under 'stupor', and we have seen that the chances of recovery are on the whole favourable in this form. But all forms tend to be deteriorating psychoses. If rightly diagnosed, all cases of dementia præcox should be incurable.

The Mental Disturbances of Decadence—The Climacteric and Senility.—When we come to that period at which men and women turn the corner of life, when they pass into the first stage of decadence and involution, and particularly when they arrive at its later stages, in old age, some of them are liable to certain forms of mental disturbance, the symptoms of which are markedly different from those in the earlier periods of life. The pathological in them has a close relationship and resemblance to the physiological characteristics of those eras of life. The passions of life have lost their intensity, its ideals and emotions are less keen, the driving power of sex and all that it implies in life is fading away or is past, the general result being that when the mind becomes unsound it tends towards melancholy, to a want of interest in life, to a *tedium vitæ*, and a general diminution in originating and energizing power. There are bodily changes pointing to the same general result. The red corpuscles of the blood markedly diminish in number, certain glands lessen in bulk, the countenance and eye are less mobile and expressive; poetry, fiction, and love tales cease to have the power to set the brain on fire. The general social instincts remain, but they assume different forms from those of youth. The subtle interest of the society of the other sex is less overmastering. Friendship and comradeship take the place of love of the fervid sort. The climacteric period begins in the woman earlier than in the man, and its signs are more marked; but it also occurs in man at a later period of life,

and in a less marked form. The 'grand climacteric' of the Romans may be put down in man as occurring at about the age of sixty-three. In some of the lowest animals reproduction is at once followed by death; in man the loss of the power of reproduction is followed by lessened mental and bodily intensity. The symptoms of climacteric unsoundness of mind in five cases out of six take a melancholic character. The sleep becomes broken, the appetite for food is less intense, the skin gets muddy, the patient has fears and fancies sometimes of an intense character. She is often terrified that she will lose control over herself or even commit suicide. She blames herself for all these feelings, and this is a cause of distress. Work is difficult. In some cases there are hallucinations of hearing. In men, initiation, courage, and mental aggressiveness are lessened. There is often a tincture of hypochondria in the mental symptoms, and a feeling that life is no longer worth having.

The prognosis in these conditions is not so unfavourable as is commonly supposed. It must be kept in mind that the epoch is not a sudden one. It begins slowly, and it takes several years, at least five in most cases, to get completed. In women 57 per cent recover, but in men only 31 per cent. I do not give up hope of recovery in climacteric cases for at least five years. The signs of recovery are a return to a reasonable enjoyment of life, but with less intensity in it. Weight should be gained, fat should be put on, the sleep should become normal. The post-climacteric happiness and power of work are not as great as in the former life, but there are many women of the nervous temperament who experience a quiet comfort and happiness which they have never enjoyed before. The storms of life are, as it were, past; the patients have sailed into smooth water. During the climacteric, whether normal or abnormal in its character, I have a profound belief in changes of environment, and especially in living in the fresh air. Suicidal feelings must be carefully looked for in both sexes, because, though these are not usually intense, yet there are exceptions to this rule. There are a few cases of climacteric unsoundness in both sexes that assume the exalted form; agitated melancholia also occurs. My experience is that the more acute and decided the mental symptoms are, the less chance there is of recovery. When these acute symptoms abate, the patients are apt to pass into a senile condition before the usual age of dotage.

Old Age.—The normal psychology of old age has been frequently depicted, from Shakespeare's *King Lear* onwards, but an exact scientific record which takes into account, not only the heredity of mental breakdown, but the heredity in regard to long life, has not been made as yet; especially the brain point of view: its vascular and its cellular elements have not been taken into account as they should have been. Many cases of breakdown in old age are primarily due to vascular conditions and consequently insufficient blood-supply to the nerve-cells. Atheroma and arteriosclerosis are both very common in all degrees in old people. Sometimes they are general, sometimes localized. The blood-pressure is always increased in old age on account of the loss of elasticity in the arteries. The brain at that time, neither in its vessels nor its cells, can stand too much alcohol, though the immediate effect of that substance is often cheering and comforting. Heredity comes in as a predisposing cause of senile changes in an apparently less degree than in any other forms of mental unsoundness except general paralysis; but the facts about heredity are further back and more apt to be forgotten. Senile insanity is apt to assume one of three forms: either a melancholia like the climacteric form, or a maniacal period of excitement, or a condition of senile dementia which may be the termination of the other two forms. My experience, from the study of hundreds of cases of senile insanity, is that about one-third of them were of the depressed type, and of these 30 per cent recovered, some of them completely, and in others all the acute symptoms passed away, so that they could return to their homes. This form of the disease does not necessarily end in either dementia or death. One-tenth of the cases had acute attacks of excitement, in fact in many cases acute mania. Some of these were short sharp brain storms preceding death, or outbursts of delirious excitement accompanying the break-up of the organism. They are exceedingly apt to precede attacks of paralysis, and most of them are accompanied, if not caused, by vascular disease. While few of these recover, yet this sometimes happens, but in an imperfect degree.

In regard to cases of simple senile dementia or aggravated dotage, these are not commonly sent to institutions, and, if possible, should not be so sent. As might be

expected, the cases of senile mental depression that occur in the earlier senile [stages, that is, from seventy to seventy-five, are apt to show less arterial disease, and therefore recovery takes place in a real and complete form. The risk of speedy death in most of them is considerable. Thirty per cent die as the result of their attacks, half of them within the first six months of a residence in institutions. The acuter class of cases is extremely difficult to manage on account of the sleeplessness and restlessness. It needs the very best nursing arrangements to cope with them, and if these are not provided, the risk of death is very great. Exhaustion, bed-sores, gangrene, paralysis, are all common.

I have commonly found that the milder degrees of senile excitement may in the beginning be effectually treated by small doses of bromide of potassium and sulphonal, commencing with not more than five grains of the sulphonal and ten grains of the bromide twice a day at the most, and as an occasional night sedative.

If a case responds to this, and the acute sleeplessness subsides, with a reasonable amount of sleep at night, the patient is manifestly much the better for it. It gives him the brain rest that is so much needed in these cases, and it should not interfere with the appetite. After a week or two the medicines should frequently be omitted experimentally to see if the patient can do without them. Insomnia notoriously in many cases becomes a brain habit, and by breaking the habit and re-forming the habit of sleeping, the patient may often go on without sedatives or hypnotics. It is always desirable, if there are means and proper nursing, and arrangements can be provided, that an old man or woman should stay at home and not be sent to an institution. This seems somehow to be the natural right of any citizen, and is almost always greatly appreciated by near relatives. There are some senile cases, however, even at the advanced ages, whose symptoms are so acute, so troublesome, and so exhausting to all who have to do with them, that institution treatment is necessary; but all good institutions now have hospital wards where the arrangements are specially adapted to treat such cases.

RARER ETIOLOGICAL AND CLINICAL FORMS OF MENTAL DISEASE.

In addition to these etiological and clinical forms of mental disease, of a somewhat definite type, there are many others of a less common kind :—

Mental Symptoms from Influenza.—Since the year 1890, when the first great wave of influenza swept over the country, there have been a large number of cases where the primary disease was complicated by nervous and mental symptoms. In fact, it may be said that every attack of influenza in some way or in some degree lowers the nervous tone, either during the attack or afterwards. These results often assume the form of depression of spirits, and a lessening of the nervous energy, which lasts for weeks and sometimes for months after the actual disease has passed away. Many of us who have had severe attacks of influenza feel that we have been the worse for it permanently. I have been in the habit of saying that influenza has left the nervous and mental tone of Europe and America lower by many degrees than it found it. Some of the cases of melancholia were very marked in both their bodily and mental symptoms. They had depression of mind, lethargy, a feeling that life was scarcely worth having, anæmia, want of appetite, digestive troubles, or loss of weight. I do not say that there is any post-influenzal insanity of a special type. I have seen the motor energy of the body affected so that it simulated early general paralysis. I have seen the memory markedly affected for many months. I have seen cases where a drink craving was established for the first time. The treatment of all these conditions is very well known—rest, mostly in bed, tonics, change of air, careful attention to diet, and freedom from business anxiety. Most of the influenzal cases recover after a few weeks, and respond to treatment readily. The great thing is to keep up the treatment and the régime for a considerable time after the symptoms seem to have passed away. I observed a curious fact, which may be a coincidence, that after the great epidemic of influenza of 1890, which affected almost everyone, the general type of mental disease sent to the Royal Edinburgh Asylum, which admits all classes of society, became more of a melancholic type than it had previously been. Before that, states of morbid elevation prevailed largely over those of depression. Since that time the melancholics have almost equalled in number the maniacal cases, and in some years have exceeded them.

Diabetic Mental Symptoms.—A very large number of the cases of diabetes have some mental or nervous symptom in addition to the liability to diabetic coma. It usually takes the form of depression, irritability, and incapacity to do the usual amount of work, mental or bodily. I have seen acute cases of melancholia arising in diabetes, most of them dying of the attack. The treatment of these nervous and mental affections is that of diabetes, and the prognosis is certainly very unfavourable.

Bright's Disease with Mental Symptoms.—A few cases of Bright's disease show marked mental symptoms, usually of the toxic character. They begin with irritability and moroseness, passing into acutely maniacal symptoms with periods of delirium. This condition I look on as an equivalent of the convulsions that are common in the disease, probably determined by the fact that the patients had a bad neurotic heredity which rendered them more than normally liable to be affected by any toxin in their higher cortical regions.

Phthisical Insanity.—The early, and what used to be called the prodromal, stage of phthisis is, in a certain number of cases, accompanied by somewhat distinctive mental symptoms: suspicion, slight mental enfeeblement, unsociableness, mild attacks of excitement, incapacity to follow regular employment, with digestive and nutritional weakness, which I called 'phthisical insanity'. My study of this condition led me to believe that about 3 per cent of the cases sent to mental hospitals were of this character. I used to think that it was a very incurable form of mental affection; but the modern treatment of phthisis, when applied to these cases, results in a larger number of cures than I used to see. I now believe that the cause of such mental disturbances is due to the toxic influence of the tubercle bacillus on the brain in persons specially predisposed to mental disease. The recovery-rate of this psychosis under the present treatment of phthisis may be put down as about 50 per cent.

Mental Symptoms in Acute Rheumatism and Chorea.—In a few cases of the typical acute rheumatism which we used to see before the salicylic treatment was introduced, the patients would suddenly become very acutely maniacal, this being accompanied with an extremely active form of chorea. The rheumatic temperature would keep up during this state, while the joint affections would cease. Most of the cases recovered, but in a few death took place during such acute attacks. I have no doubt whatever that these resulted from a metastasis of the rheumatic toxin or micro-organism from the joints to the spinal cord and brain cortex. It was very relapsing in character, in this way following the lines of uncomplicated rheumatism. Its treatment is that of the acute rheumatism, by salicylates, etc. Too few cases have been put on record to give reliable statistics of curability. My impression is that such cases are far less frequently seen now under the modern treatment of acute rheumatic fever than formerly.

The ordinary chorea of early adolescence is complicated in a few cases by a delirium accompanying inco-ordinated muscular movements. The patients first show depression, and then this delirious mania, which may be accompanied by acts of violence and suicide. Most of such cases recover, but there are a few who die of exhaustion. The treatment is that of chorea, plus the employment of hypnotics and nerve sedatives. We may have to resort to hyoscine in some of the cases, and its effects, by diminishing the motor symptoms, often give extreme relief, for the time being at least. Most of the cases recover soon and have no relapses.

Masturbational Mental Symptoms.—The habit of masturbation is a frequent accompaniment of many forms of mental disease, and in that case it always aggravates the mental symptoms, tending to produce mental irritability and confusion. On the whole it worsens the prognosis if persistent. There is in addition a distinct form of insanity associated with and caused by masturbation. This is not, however, nearly so common as is popularly and even medically supposed. It is far more frequently a symptom than a cause, and when present it is not nearly so incurable a malady as is imagined. My experience is that 35 per cent of my cases of the disease made good and mostly permanent recoveries under right bodily, mental, and moral treatment. Some of these cases had a tinge of congenital mental weakness, which was, of course, incurable.

Myxœdema and Exophthalmic Goitre.—The mental symptoms which are liable to accompany these two conditions are fairly well known. In both cases they often become so severe that patients have to be sent for treatment to mental hospitals; at least that

was so in the case of myxœdema before its treatment by thyroid extract was discovered. The symptoms are in some cases depression, and in some exaltation of mind, but they all have tendencies to hallucinations of hearing. They all have a lowered vasomotor tone, a slowness in the reaction time, and a general lethargy of voluntary movement. All the cases I have had since the thyroid treatment was discovered have recovered.

The mental symptoms in exophthalmic goitre are irritability, a tendency to delusions of suspicion, and, in the worst cases, acute mania of an extremely fatal character. Accompanying such mental symptoms are the usual bodily signs of the disease. We are yet awaiting an entirely satisfactory treatment for the disease. A surgical removal of part of the thyroid gland has lately been reported by several surgeons to have good results.

The Delirium of Young Children.—The delirium to which all children are liable from high temperatures and toxic causes is, in some cases, so intense and prolonged as to become a cause of anxiety. Such delirious conditions mean that the children affected are of an extremely neurotic temperament, this complicating almost every form of disease to which they are liable. It means also that they should be specially cared for in after life, with the object of antagonizing the effects of their temperament. The fact should be taken into consideration in many cases in education, selecting employments, etc.

The Mental Symptoms of Lead and Arsenical Poisoning.—The salts of these two metals, when slowly absorbed into the system by painters and those who have drunk much beer adulterated with arsenic, are liable to cause mental symptoms, which may go on to coma. Hallucinations, morbid elevation, maniacal attacks, and delusions of persecution are the chief symptoms. There have been cases of coma and death following such symptoms, but most of the cases will recover if proper treatment is applied in time.

THE GENERAL PROGNOSIS IN PERSONS WITH A MENTAL AND NEUROTIC HEREDITY BUT NO ACTUAL MENTAL SYMPTOMS.

The change from a potentiality and tendency into an actual mental disease is always an uncertain matter, on account of the absence of reliable statistics and of scientific prognostic indications, as well as from the fact that the tendencies to actual disease through hereditary defects vary so infinitely in their strength in different cases.

The risks of the occurrence of mental disease in many persons are questions constantly referred to doctors nowadays, but it is rare that a certain prognosis can be given in any individual case. So much depends on the circumstances and environment of the person, on his employment, on his innate vitality and general health, and on his habits of life, as well as on his heredity, that our conclusions are made uncertain in most cases. On the one hand a certain amount of bad heredity exists in so many families that we must not draw too fine a line, and on the other the evil consequences to the individual, to the family, and the race may be so great that we must not shirk from pointing out the obvious risks. There are, in fact, prognostic risks that may be taken by any man or woman in choosing a profession, in choosing a residence, or in getting married, but on the other hand there are risks that no prudent and conscientious man or woman should take. The chief consideration which should guide the medical adviser are the strength and directness of the evil heredity, and the constitution of the person about whom our advice is sought. In every case I would say to the applicant for advice that our present knowledge of heredity is defective and uncertain, so that we may be mistaken in our conclusions. The following, I would say, are the most relevant facts, so far as our present knowledge goes:—

1 Mental disease in the father or mother implies a considerable and necessary risk in the offspring.

2. The risk is greater from the father to the daughter or from the mother to the son, especially if there are also bodily or mental likenesses.

3. On the whole there is more risk from the maternal side.

4. If mental disease has been common 'in the family', the risks are the greater.

5. If the person about whom our advice is asked is obviously 'neurotic' in constitution, and has 'stigmata of degeneration', bodily or mental, the risks are thereby accentuated.

6. If the general health has been much below par, especially during the period of development, the risks are greater.

7. If any developmental diseases have occurred, such as convulsions, asthma, chorea, severe hysteria, tuberculous affections, etc., even though they may have been recovered from, the risk is greater.

8. If mental affections have appeared in near relations in the early periods of life, the risks are far greater than if they have appeared later on.

9. Many of the neuroses, notoriously epilepsy, occurring in ancestry, are liable to be 'transformed' into mental attacks in descendants—mental attacks are, in fact, their 'equivalents', looked at from the hereditary point of view.

10. Alcoholic, syphilitic (including general paralysis), traumatic, and toxæmic mental attacks may not necessarily imply any mental hereditary element.

11. In some cases mental attacks will appear in members of a family with an entirely clean bill of health so far as the facts are ascertainable.

T. S. Clouston.

MERCURIALISM.—Patients who are affected with tremor as the result of inhaling mercury vapour may not suffer from any other manifestation. Removal from the influence of the poison may be followed by rapid recovery, though in some cases the tremor never entirely passes away, and may remain with undiminished intensity. Nervous symptoms rarely follow the medicinal use of mercurial salts, but arise most frequently in those who work with the metal. Weakly people suffer much more severely than the robust, and there is a very marked individual susceptibility. The symptoms may arise for the first time when an interval has elapsed since the last exposure. These symptoms include colic, nausea, vomiting, depression, salivation, diarrhœa, red and swollen or ulcerated tongue and gums, associated with general trembling of the limbs, weakness and emaciation. Difficulty in swallowing and in breathing render the prognosis much more grave. Another serious symptom is the peculiar mental agitation displayed by some of these patients.

With regard to oral administration, it is stated that the taking of 3 gr. of perchloride of mercury has been followed by death. On the other hand, a case has been recorded in which extensive alveolar necrosis and parenchymatous nephritis followed the ingestion of $7\frac{1}{2}$ gr. of perchloride of mercury, and in spite of this the patient eventually recovered.

Of the more acute manifestations, the following justify a very grave prognosis: œdema of the glottis may rapidly follow a large concentrated dose, leading to speedy death from asphyxia; severe gastro-intestinal disturbance with frequent vomiting of blood-tinged material; diarrhœa with bloody evacuations; extensive stomatitis, followed by sloughing of the gums and the inside of the cheeks; sudden collapse; and, in somewhat less acute cases, marked cachexia with œdema round the ankles. The prognosis is much worse if there is any coincident nephritis.

Some patients die with acute cerebral symptoms, beginning perhaps with hallucinations, passing on to a stage with epileptiform convulsions, or acute mania.

Chronic mercurialism in women favours miscarriage and the birth of still-born children. In both sexes it undermines the resistance of the body, and paves the way for phthisis, or some acute infection.

J. R. Charles.

MIGRAINE.—Migraine, with its characteristic paroxysmal headaches, generally unilateral, frequently preceded by the well-known visual phenomena, and usually culminating in vomiting, does not involve any direct danger to life. Migraine is a family disease, which generally appears in childhood, and subsequently recurs, often with remarkable periodicity, at intervals of about three or four weeks throughout adult life, ultimately tending to disappear in old age. In women, the attacks are specially liable to occur towards the end of each menstrual period. In addition to the natural tendency to spontaneous recurrence, there are frequently sources of peripheral irritation which precipitate or aggravate an attack at the end of a particular cycle of time in each patient's case. Sometimes recognition and correction of such accessory factors as errors of refraction (these should always be looked for), nasal or dental abnormalities, gouty diathesis, etc., may produce a remarkable diminution both in the frequency and in the severity of the attacks; but the disease is essentially an hereditary and constitutional one, and therefore entire cessation of the attacks is not to be expected. Gowers thinks that cases in which the face becomes cold and pinched during the attack have a more favourable prognosis, as regards mitigation of the attacks, than when the face is flushed at the onset of the paroxysms; but it is difficult to be sure of this.

J. Purves Stewart.

MITRAL DISEASE.—(See HEART, CHRONIC VALVULAR DISEASE OF; RHEUMATIC ENDOCARDITIS.)

MOLES (Simple).—These tumours are congenital local defects of development in the skin. They are characterized by warty overgrowth of the papillæ, and often by the presence of hair, but above all by the presence in them of groups of chromatophores or pigmented connective-tissue cells, which give to the mole its characteristic dark colour. In certain moles pigment is absent.

The prognosis is good. There are few individuals who do not possess them. But in two contingencies their potential malignancy may awake. If the mole is subjected to any injury, and especially to chronic irritation such as chafing, melanotic sarcoma may supervene, heralded by increase in size and elevation, and by repeated bleeding, followed by enlargement of glands. The second contingency is injudicious treatment. Caustics and partial excision are most dangerous. Attempts to treat moles by radium therapy have not met with much success, and those with most experience of this form of treatment are least inclined to recommend it. Thus, Hayward Pinch in a recent report of the Radium Institute deprecates the use of the method. Either a mole must be severely let alone, or it must be treated, like the aspiring relatives of an Oriental despot, by complete extirpation. Clean excision with the knife should always be performed when the mole displays signs of activity, and in any case if it is subject to chronic irritation, as on the sole of the foot, the inner side of the thigh, the neighbourhood of the anus, or in the region of the collar.

W. Sampson Handley.

MOLES, VESICULAR (Hydatidiform Mole).—The dangers of a vesicular mole are: (1) Excessive hæmorrhage during the spontaneous separation and expulsion of the mole, or during its surgical removal; (2) Perforation or rupture of the uterus by the mole, either spontaneous or instrumental; (3) The coincident or subsequent development of chorion-epithelioma.

1. Excessive Hæmorrhage.—Great bleeding may be caused by a vesicular mole, but it is rare for a patient to die from this cause alone. Even after apparently complete spontaneous expulsion, it is usual for bleeding to go on and necessitate uterine exploration. All vesicular moles should of course be removed surgically as soon as diagnosed. More than this: even after apparently complete natural expulsion, it is safest to explore the uterus and to curette gently with a blunt curette, so as to make sure that no fragments remain capable of giving rise to chorion-epithelioma subsequently. Two dangers accompany the removal of a vesicular mole: one is the occurrence of great hæmorrhage, which must be avoided by operating only after exciting uterine action by preliminary packing of the uterus and vagina with gauze and by injections of pituitrin; the other is instrumental perforation of the uterine wall, which is sometimes thinned by the eroding action of the mole.

External hæmorrhage is most marked in the non-malignant variety of these moles, and indicates an attempt on the part of the uterus to expel the mass. In some cases this is successfully accomplished; but more commonly only a portion of the growth is extruded, because the adhesion of the villi to the uterine wall is generally far firmer than obtains in normal pregnancy.

2. Perforation or Rupture of the Uterus.—Spontaneous rupture is extremely rare. In a certain proportion of cases the chorionic villi penetrate deeply into the wall, even to the peritoneal surface, and in such cases the risk of perforation during exploration or curettage is evident; while it is in such cases that spontaneous rupture occurs—during the contractions of the uterus in the attempt to expel the mole. The internal hæmorrhage in such cases has often proved fatal.

3. The Coincident Development of Chorion-epithelioma.—This is an eventuality for which one must always be on the look-out. Chorion-epithelioma follows vesicular mole more often than any other form of pregnancy. For example: Teacher,¹ in his series of 188 cases of chorion-epithelioma, found that 37 per cent followed vesicular mole; and Hitschmann and Cristofolletti,² in 240 cases, found that in 48 per cent the preceding pregnancy was a vesicular mole. As regards the frequency with which chorion-epithelioma may be expected to occur, the latter authors give statistics of 200 cases of vesicular mole, in which they carefully followed up the after-histories, and found that 15, or 7·5 per cent,

resulted in chorion-epithelioma. It follows that every patient with vesicular mole should be kept under close observation for several months, and have her uterus explored if suspicious symptoms (i.e., irregular uterine hæmorrhage) appear; all material removed by the curette should be examined microscopically. As regards the routine microscopical examination of vesicular moles, unfortunately it happens that no great reliance can be placed on the histological features of the chorionic villi as giving indications of malignancy.

Complications.—Finally, a few of the rarer complications of vesicular degeneration are vomiting, albuminuria, and even eclampsia and sepsis. In these cases a condition of lowered resistance ensues in which a hæmorrhage may be attended by a rapidly fatal result, or in which a septic infection is prone to develop.

Figures relating to the effect of molar pregnancies upon fertility are lacking, but there exist numerous observations in which pregnancy has supervened not once, but on several occasions. It is even asserted that sterility is rare after a molar pregnancy.

Once a hydatid mole has been successfully cleared out, there are no remote effects to be feared beyond the possibility of subsequent chorion-epithelioma developing.

Mortality.—From all causes Brindeau³ states that the mortality in vesicular mole is about 15 per cent of the cases.

In the figures of Findley,⁴ representing 210 cases collected from the literature, there were 49 deaths, a mortality of about 25 per cent. Of this number, 32 died from malignant degeneration, or 16 per cent; 7 died from hæmorrhage, or 4 per cent; 4 from septic peritonitis, or 2 per cent; 1 from general sepsis, 1 from uræmia, 1 from endocarditis, 1 from meningitis, and 2 from unknown causes.

REFERENCES.—¹Teacher, *New System of Gynecology*, 1917, ii, 583; ²Hitschmann and Cristofolletti, *Wien. klin. Woch.* 1911, Nos. 19 and 20; ³Brindeau, *La Pratique de l'Art de l'Accouchement*, 1914; ⁴Findley, *Diseases of Women*, 1914, 174.

Eardley Holland.

MORPHINE HABIT.—(See DRUG HABITS.)

MOVABLE KIDNEY.—(See KIDNEY, MOVABLE.)

MUMPS.—Mumps is only exceptionally fatal. Amongst 58,331 cases occurring in Denmark during the years 1870 to 1894 and reported by Ringberg, there were only 7 deaths, of which 3 were in children. Comby states that there was 1 fatality amongst 496 cases in the French army during the years 1862 to 1865; but Denime, at Berne, reported 2 deaths in 117 cases. There were no deaths amongst 219 cases in soldiers admitted to the North-Western Hospital, Hampstead, from November, 1916, to September, 1917; nor was there a single death from the disease amongst 694 cases of mumps occurring in soldiers (age 18 to 40 years and mostly Australians), recorded by G. Macleod. It is rarely fatal except from complications.

Complications.—*Orchitis* is the most serious complication: not because it is at all frequently associated with a fatal result, for that is not the case, but because it often terminates in atrophy of the testis. Orchitis usually sets in about the seventh or eighth day of the illness, but may occur at any time within six weeks; it may follow a mild attack of mumps. It is most frequently met with in young men, and is rare in little boys and old men. Its frequency appears to vary considerably in different epidemics. Catrin states that it occurs in 16 per cent of males of all ages; but Laveran and Comby put the incidence much higher, from 30 to 33 per cent. Comby, however, refers only to epidemics in the French army. There were 58 cases (26.4 per cent) amongst the 219 soldiers admitted to the North-Western Hospital, and 140 (20 per cent) amongst Macleod's cases. Catrin's estimate is probably nearest the truth as regards males of all ages.

A large proportion of the cases of orchitis end in atrophy: 60 per cent according to Catrin, 70 per cent according to Laveran. A relapse of orchitis may occur, but is very rare. Suppuration of the testis must be very rare, if it ever occurs; there was no instance of such an event amongst either Macleod's or the North-Western cases.

Very severe cerebral symptoms occasionally arise during an attack of mumps, either during the parotitis or after the testis has become affected. But as a rule such symptoms do not last long, and the patient recovers without any cerebral or mental after-effects.

Pancreatitis is another complication which is accompanied by alarming symptoms. It usually arises within a week of the onset of the attack of mumps. It has been known

to occur in as many as 5 out of 33 cases (in an outbreak reported by Edgecombe). There were no cases amongst the 219 soldiers at the North-Western Hospital; but Macleod met with 8 cases presenting symptoms suggestive of this complication. There may be severe abdominal pain, vomiting, and collapse. But in spite of the apparent severity, the prognosis is nearly always favourable.

Permanent deafness is, rarely, the result of an attack of mumps. The cause is usually inflammation of the internal ear. There was 1 case of earache with temporary deafness, and 1 of otorrhœa, amongst the 219 North-Western Hospital cases. There were also 3 cases of *nephritis*, 2 of *laryngitis*, and 1 of *bronchitis*, amongst these patients. Amongst Macleod's cases were 3 of earache and deafness, and 8 of laryngitis.

Suppuration of the parotid gland is rare; there were no cases at the North-Western Hospital, and only 2 amongst Macleod's patients. There were 11 cases of *relapse* amongst Macleod's 694 cases. The relapse occurred from the 10th to the 30th day.

E. W. Goodall.

MUSCULAR ATROPHIES.

Arthritic Muscular Atrophy.—In this form, which accompanies any acute or chronic joint affection, and which is limited to the muscles around the affected joint or joints—being usually more marked in the extensors than in the flexors—the prognosis depends upon the recovery of normal mobility in the affected joint. The absence of fibrillary movements, and the presence of electrical reactions which are normal or, at the most, merely quantitatively diminished, are here of corroborative value. Suitable massage and movements of the affected muscles and joints rapidly produce improvement, the ultimate result being proportional to the degree of mobility attained at the particular joint.

Ischæmic Muscular Atrophy (v. Volkmann's paralysis), the result of muscular compression by splints or bandages which have been too tightly applied, is met with only in the forearm, and is confined to the muscles on the flexor aspect of the hand. Within a few hours, the forearm muscles become tender, and the fingers and hand swollen; and unless the splints are removed and properly adjusted forthwith, the affected muscles are gradually infiltrated by fibrous tissue, causing them to become hard and leathery in consistence, with impossibility both of active contraction and of passive stretching. In this variety of muscular atrophy, due to interstitial myositis, the contracture of the wrist and fingers, once established, is obstinately resistant to ordinary massage and electrical treatment; and in severe cases the best prospect of regaining a useful limb is offered by the excision of a portion of the radius and ulna, thereby shortening the forearm to correspond with the shortened flexor muscles. It is seldom, however, that operative interference is required. Most cases can be gradually relieved by continuous passive extension or splints. First straighten the fingers, followed a few days later by the metacarpophalangeal joints, and later the wrist, extending it more and more and keeping it so, on a splint, until hyper-extension is obtained. This continuous passive extension, interrupted only for daily massage, cures most cases of moderate severity.

Neuritic Muscular Atrophy follows lesions of motor or mixed nerves, whether in isolated affections of individual nerve-trunks (such as the facial, ulnar, or musculospiral), or in multiple neuritis from any cause (alcohol, lead, arsenic, diabetes, beri-beri, malaria, diphtheria and other infective diseases, etc.). The prognosis varies according to the underlying cause, and according to the degree of degeneration which has occurred in the affected motor nerve. Sometimes the cause cannot be removed, as in diabetic neuritis. In other cases, as in alcoholic neuritis, it is removable with considerable difficulty. In others again, as in diphtheritic and malarial neuritis, and in ordinary 'rheumatic' facial palsy, there is a tendency to spontaneous recovery. Accurate diagnosis of the cause is therefore of supreme importance. The degree of degeneration that has occurred in the nerve and muscle fibres, in any particular case, is determined by the examination of their electrical reactions.

Myopathic Muscular Atrophy.—In this form—whether of the pseudo-hypertrophic type, or of the primary atrophic type (where the disease, congenital in origin, consists in a primary decay of the striated muscle-fibres, with a reversion first to an embryonic non-striated structure, and ultimately ending in disappearance of the contractile sarcoplasm)—the prognosis is unfavourable as regards recovery. The rate of progress of the disease, however, varies within wide limits. Some patients become bedridden and

helpless within a few years, and die (from some intercurrent disease) before attaining adult age. In others, the disease advances with extraordinary slowness, and the patient may be able to get about for thirty or forty years after the onset of his symptoms. Other cases, again, seem to come to a standstill, and remain at the same stage of muscular atrophy for an apparently indefinite period. Patients with myopathy, however, rarely live to an advanced age. The pseudo-hypertrophic form has a relatively worse prognosis as regards life than the primary atrophic type.

Progressive Muscular Atrophy (peroneal or Charcot-Marie-Tooth type), which usually begins in childhood and adolescence, and is characterized by wasting of the peripheral muscles of the limbs which leads to early claw-hand and to talipes, bilaterally symmetrical, has a prognosis very similar to that of the myopathies: i.e., it progresses with extreme slowness, and may even come to a standstill. Here the prognosis as to life depends upon preventing the patient from becoming bedridden. The orthopædic surgeon can often prolong life, either by providing suitable supports for the feet and knees, or by various operations upon the contracted feet, enabling the patient to get about, even when all the muscles below the knees are completely paralyzed.

Progressive Muscular Atrophy (chronic anterior poliomyelitis), from degeneration of the anterior cornual cells, may affect the spinal cord alone, or it may also attack the medullary motor nuclei, producing *bulbar paralysis* (see BULBAR PALSY). In nine-tenths of the cases the muscles of the upper limbs are attacked earliest, especially the intrinsic muscles of the hand. Sclerosis of the pyramidal tracts, which frequently accompanies the anterior cornual lesions, is evidenced by increase of the deep reflexes, especially in the lower limbs, and by the development of an extensor type of plantar reflex. The malady is usually progressive, but sometimes it becomes arrested. The chief dangers to life arise when the respiratory muscles are affected, or when, from bulbar palsy, deglutition is rendered difficult; in such cases, not only does malnutrition result, but there is a risk of inhalation-pneumonia. In cases which become arrested as a result of treatment, the atrophied muscles do not recover; there is simply a halt in the advance of the symptoms. The prospects of such arrest are improved by systematic hypodermic administration of strychnine, beginning with $\frac{1}{80}$ gr. daily, and quickly increasing to $\frac{1}{10}$ gr. and $\frac{1}{15}$ gr. according to the régime laid down by Gowers, which should be persevered with for many months. Electrical treatment does not appear to affect the progress of the disease materially, but sometimes *x-ray* treatment over the medulla, in cases of bulbar palsy, has apparently brought the degenerative process to a standstill.

The muscular atrophy of acute anterior poliomyelitis is referred to in the article on INFANTILE PARALYSIS.

J. Purves Stewart.

MYASTHENIA GRAVIS.—There are few diseases in which it is more difficult to form an accurate prognosis in an individual case than in myasthenia gravis. Once the disease has been recognized by the presence of the characteristic and transient fatigue of certain groups of muscles, especially the ocular, facial, masticatory, palatal, laryngeal, pharyngeal, and tongue muscles, the large proximal muscles of the limbs, and, most dangerous of all, the respiratory muscles—once these phenomena have become established, the outlook is grave. Some cases have been known to end fatally within a few weeks; others again, with symptoms apparently no less severe, have survived for five or ten years, or even longer. Spontaneous remissions not infrequently occur if the patient leads a quiet life, free from physical exertion. Hard manual labour, or physical effort of any sort, aggravates the symptoms.

The immediate cause of death is generally an attack of fatigue of the respiratory muscles. Sometimes individual attacks of this sort may, for the time, be tided over by means of artificial respiration, combined with oxygen inhalations. Every myasthenic patient ought to have a cylinder of oxygen at hand with the necessary tubing attached, ready for such an emergency. Fatigue of the muscles of deglutition may cause attacks of choking, and is another sign of serious significance.

J. Purves Stewart.

MYCOSIS FUNGOIDES.—This rare, but dangerous, skin disease shows two stages: there is first an itching erythematous rash, which may last for years; then fungating tumours form in the skin and become numerous and widespread. There is always

great pruritus. The tumours have been compared to a tomato in appearance. After a long course, two to twenty years, the disease ends fatally, the patient being carried off at last by sepsis and exhaustion. Occasionally metastases appear internally. Until radiotherapy was introduced, the prognosis was regarded as hopeless, although in rare instances the tumours might spontaneously disappear. In the majority of cases x rays cause the disappearance of the signs of the disease. Sometimes they recur; sometimes the patient remains free for years.

REFERENCE.—Sequeira and others, *Proc. Roy. Soc. Med. (Dermatol. Sect.)*, 1914.

A. Rendle Short.

MYELOID SARCOMA.—(See BONE TUMOURS.)

MYOCARDIUM, PRIMARY DISEASE OF.—To say that the outlook in any case of valvular disease depends ultimately on the state of the cardiac muscle is to utter an obvious platitude. Yet there are degrees in the paramount importance of the myocardium. In the kind of case that is usually described as one of chronic valvular disease, the two factors to be assessed are the amount of extra work imposed on the myocardium by the valvular lesions, and the fitness or unfitness of the myocardium to meet that extra demand. On the other hand, there is a group of cardiac lesions that attack the musculature of the heart directly and immediately, either with or without a simultaneous injury to the valves and other accessories of the cardiac mechanism. In such cases the prognosis will have to be calculated in respect of two factors: (I) *The course usually followed by the morbid process at work in that particular case*; and (II) *The nature and extent of the injury to function discernible at the time of examination*.

I.—PROGNOSIS ACCORDING TO THE PARTICULAR MORBID PROCESS PRESENT.

The primary diseases of the cardiac muscle may be (1) *Acute*, or (2) *Chronic*. Those which constitute the former group are for the most part infective.

1. Acute Infections of the Cardiac Muscle.—There are four acute infections in which myocardial lesions play a predominant part: diphtheria, rheumatic infection, typhoid fever, and influenza. Of these the rheumatic infection is the only one in which the valves and pericardium are also attacked; and even here, these lesions do not attain to such a pitch of intensity during the active phase of the rheumatic process as to share prognostic importance equally with the damage which has been inflicted directly upon the myocardium by the infection.

In *diphtheria*, it would appear that about 25 per cent of all the deaths are due chiefly or solely to cardiac failure. In other words, if the average mortality of this disease be reckoned at 10 per cent, there is a chance that one person out of every 40 attacked by diphtheria will die of cardiac failure. Sudden syncope is fairly frequent in cases carelessly treated. It is quite impossible to assess in figures the effect of antitoxin treatment in reducing these risks, but it is tolerably certain that the risk of cardiac failure is directly proportional to the intensity of the infection itself; and since nothing is so potent as antitoxin in combating the virulence of the infective process, it follows that one of the chief benefits of the treatment lies in the fact that it interposes a kind of barrier between the infected mucosa and the susceptible tissues of the cardiac wall. This is borne out by the fact that serious and fatal cardiac phenomena are much more often met with in cases of diphtheria where antitoxin treatment has been delayed than in those treated early. One other point that is of the highest import in the prevention of cardiac failure is the absolute necessity for care in regard to convalescence. A very large fraction of the fatal attacks of syncope occur during convalescence, after the severity of the infective process has died down. These catastrophes are due to changes in the peripheral circulation as well as in the cardiac muscle. Measurements of the blood-pressure are of great value in this connection. Recovery is not impossible even when the systolic pressure falls as low as 60 mm. Hg (Harding), but a patient with so low a pressure is in great danger. This can only be averted by the utmost care, and the blood-pressure should therefore be measured systematically in severe diphtheria.

Acute rheumatic carditis is dealt with under a separate heading (see RHEUMATIC PERI-, MYO-, AND ENDOCARDITIS).

In *typhoid fever* the cardiac factor is probably of more importance than appears on the surface. It is, however, obscured by the nervous and other evidences of toxæmia; and it is so unusual to encounter cases in which the chief clinical features are cardiac that these may be dismissed with the remark that sudden death occurs in a few cases of typhoid fever, but that the cardiac origin of such calamities is not definitely proved. Persistent cardiac disability following typhoid fever is a negligible quantity.

The cardiac complications of *influenza* are very important, both in relation to the possibilities of a fatal termination, and also to the duration of the period of disability which is so apt to follow this disease. Sudden death has been known to occur, but it is excessively rare. On the other hand, persons whose cardiac musculature was damaged by arteriosclerotic or other lesions before the attack, are apt to find that influenza leaves them more conscious of cardiac disability than they were before the illness. Even those whose hearts were sound before the attack are often left with minor evidences of cardiac enfeeblement; these symptoms usually pass off in the course of a few weeks, provided ordinary care as to work and rest is exercised. The reader may also be reminded of the liability to irritable heart left by influenza during the recent epidemic; and also of its possible connection with chronic ulcerative endocarditis.

In other infections, such as lobar pneumonia, scarlet fever, and so on, symptoms and signs of myocarditis are often manifest; but it is only as part of the general picture, the phenomena are mild as a rule, and death is never or almost never due to cardiac complications alone. The one possible exception is that of malaria. In this infection, at all events as it was seen in the Macedonian campaign, many of the deaths were principally cardiac.

2. Progressive Degenerations of the Myocardium.—Here there is often an overlapping of etiological factors. For instance, you are consulted by a man with thick, contorted arteries, with a history of syphilis and signs of alcoholism. His cardiac enfeeblement is probably due in some measure to all three factors; but in what measure to any particular one? So far as prognosis is concerned, the difficulty is to some extent mitigated by the fact that, whatever the cause may be, it is always possible to discover the state of the cardiac functions, and this is after all more important than precise knowledge as to the nature of the morbid processes which are playing havoc with those functions. Yet in making a forecast in disease, it is necessary to know not only where we stand at the time of examination, but also what further progress along the downward path is to be expected. It is therefore imperative to make full inquiry into the causes in any given case of chronic myocardial degeneration.

Of all the various factors, none is more serious than *chronic alcoholism*. The writer has found that it is always wise to treat with the utmost respect any case of chronic myocardial disease in which there is reason to suppose the tissues have been long subjected to the deleterious effects of alcoholism. In many of these cases the serious nature of the myocardial disorder is plain to see, for the symptoms afford the clearest possible indications of failing contractility; but even where this is not so, and the functions are not badly deranged, the fact that the patient has been in the habit of alcoholic excess bodes ill for his heart's chance of surmounting the tasks that lie ahead of it. Not only so, but there is this further disadvantage about the effect of long-continued alcoholic intemperance on the heart, that it persists after the cause has been removed. Or perhaps one can express it better in this way, that a man who has been alcoholic up to forty and abstemious since will tend to run a quicker downward course if at the age of fifty he begins to manifest evidences of cardiosclerosis. It is nevertheless true that withdrawal of alcohol in any such case will affect the outlook favourably, the more definitely so if the cardiac symptoms are as yet trivial.

Another fact of ominous significance in a case of progressive myocardial degeneration is a history or other evidence of *syphilitic infection*. This matter is more fully discussed under a separate heading (see *CARDIAC SYPHILIS*); here it is enough to say that in any case of myofibrosis cordis it is the practitioner's duty to seek by every possible means for evidences of a luetic factor. This is particularly to be suspected in cases where the symptoms are severe and the physical signs disproportionately slight. Whenever there is reason to believe that the myocardial disease is in part due to syphilis, the prognosis is much graver than in an ordinary straightforward case of senile heart. This is true even

of those cases in which there are none of the aortic lesions that constitute so characteristic a feature of cardiac syphilis. About 50 per cent of cardiac syphilitics die suddenly.

The other factors which should be looked for in a case of the kind are those which injure the myocardium through the arterial lesions that they initiate.

Of these, mere *senility* is the least grave. Many an elderly man shows signs of cardiac decay which have developed so slowly that the corresponding symptoms are scarcely perceived by the patient himself. He has to take his hills a little more deliberately than he used to do, but this gives no anxiety, since he regards it as one of the penalties of advancing years. Such a man should be told no more than this, that his heart is not so young as it was, and that he must be content to accept his breathlessness as an automatic index of the line separating what he may from what he may not undertake. That same growing old which is responsible for the signs at the time of examination is not likely to accelerate unless there be some definite force, over and above that of mere senescence, at work upon his arteries.

Of the various types of overstress to which the heart is exposed, continuous *emotional strain* appears to be the most universally deleterious. The exact manner of its action is not understood, but no one who has seen many cases of cardiosclerosis will fail to recall examples of business or family worry accelerating the final *débâcle*.

The importance of *physical strain* as a factor in the causation of myocardial degeneration is a debatable point. One thing at least is clear, that overstress of a senile heart is liable to dire consequences much more often than an even greater burdening of the adolescent or youthful heart. Mitchell Bruce's Lumleian Lectures, delivered in 1911, contain a great deal of very useful information as to prognosis in cardiovascular degeneration. In the cases which supply the fundamentals of his discourse, he found that cardiac overstrain in the young and healthy did not shorten life much, if at all, for the average duration of life after the strain was 34 years, and the average age at death 66 years.

Of other factors, *high arterial tension* is one of the most serious. A majority of such cases end in cardiac failure. There are three points to bear in mind in constructing a prognosis here. (a) If the hyperpiesis be attributable to some provocative factor that can be checked, so much the better for the patient; where it is due to something, such as manifest renal disease, that we can do little to mitigate, the outlook is bad. (b) The actual height of the pressure matters less than its course. Other things being equal, a rising tension is bad; it means an increase of the cardiac burden. Fall in pressure is also a bad sign if it be accompanied by evidences of increasing cardiac inadequacy; it proves that the heart is failing in its prime duty, that of maintaining a steady supply of blood to the peripheral organs and tissues. (c) And this is merely another way of saying that a high pressure is not necessarily a sign of evil omen—the fact that treatment fails to bring down a raised tension is not in itself to be deprecated in every case. All the organs, including the myocardium itself, depend on the maintenance of a steady blood-pressure for their nutrition; and it is probable that in many cases a high pressure is essential to the sustenance of the cardiac muscle and its functions.

Bruce, in the lectures already referred to, separates a '*metabolic*' group of cardio-sclerotic subjects—obese, self-indulgent persons, with sugar and usually albumin in the urine. The cardiac phenomena of such patients tend to run a benign course, particularly if the bad ways of living be not incorrigible. The average period elapsing between the onset of cardiac symptoms and the patient's death was $12\frac{1}{2}$ years in Bruce's cases; one patient lived for 32 years after the onset of symptoms. Of course it is necessary to recollect in this, as in renal cases, the possibilities of death from some non-cardiac cause such as uræmia or acid intoxication.

A *gouty* element in the case is not in the patient's disfavour.

On the other hand, a strong *family history of cardio-arterial degeneration* must be reckoned as an unhappy feature of the case.

In the very *obese* it is common to encounter symptoms and signs indicative of myocardial inadequacy, and these are not to be underrated. They point to an overloading of the subpericardial interstices with fat, which often infiltrates the muscle itself along its connective-tissue planes, crushing and starving the muscular fibres. Patients in this state are therefore ill prepared to cope with the emergencies of life; they fail with undue ease in the presence of acute disease, particularly bronchitis and pneumonia.

Two other factors remain for consideration—the patient's temperament and his circumstances. The worrying, splenetic individual makes a bad cardiac patient, and so does the man whose affairs are hard to escape from; and the combination of the two, sometimes encountered in successful, pushing business or professional men, is particularly deadly. To such persons the inevitable advice—"Eat, drink, and smoke sparingly, work moderately, and worry not at all"—too often appears so impossible of accomplishment that it is disregarded, and downfall ensues.

So much for the place of etiology in the prognosis of myocardial disease.

II.—INFLUENCE OF THE NATURE AND AMOUNT OF FUNCTIONAL INJURY SHOWN AT EXAMINATION.

We must next consider the *relative importance of symptoms and physical signs*, and in order to arrive at a proper understanding of their significance it is essential to realize they are merely means to an end—the assessment of the capacity of the cardiac muscle to do its work. Now, the chief end of the myocardial tissues lies in the ventricular contractions; it is to perform this task that the heart exists. Therefore the gravest features of myocardial disease are those which point to impairment of the contractility of the ventricles. Whatever the cause of the trouble, this holds good.

Impairment of Contractility of Ventricles.—We come here to a fact that has not yet received all the attention which it deserves, despite all the teachings of the past twenty years: the fact that symptoms afford a more reliable basis for the estimation of ventricular contractility than physical signs.

First among these symptoms is *breathlessness*. Often it is the first to be noticed, and the ease with which it is evoked constitutes an excellent gauge of the state of the ventricular wall. At first it is only noticed when the patient puts himself to some unusual exertion, such as climbing a hill or hurrying to catch a train. By degrees his field of cardiac response, to borrow Mackenzie's phrase, becomes more and more limited, till walking on the flat becomes a difficult task. If the ease with which dyspnoea is provoked by exertion is not obvious, it must be estimated by definite exercise tests, such as the climbing of stairs or mild physical drill; and their effect on breathing and pulse-rate closely noted. It is essential to accurate prognosis in all cases of chronic cardiac disease that we should know how much reserve force the heart has, and the easiest and simplest plan is to see how much exertion it takes to make the patient breathless. Other things being equal, the more readily the patient's breath fails, the worse the prognosis.

There are also various forms and degrees of *paroxysmal dyspnoea*, the significance of which is important in respect of prognosis. When a person with myocardial disease develops Cheyne-Stokes breathing, it does not of necessity forebode evil. For example, an elderly man with elderly arteries and some cardiac enlargement is found to exhibit Cheyne-Stokes breathing during sleep: here it is of little significance unless other signs of contractile failure begin to be manifest or the respiratory periodicity itself become rapidly more and more definite. Grouping of the respiratory movements is of importance only when it is one of a group of symptoms suggesting gradual shrinkage of ventricular contractility. When we come to an aggravated degree of the same kind of phenomenon, however—to the various forms of periodic dyspnoea with subjective distress which are grouped together within the term 'cardiac asthma'—a graver condition is encountered. And we must not be misled, by the fact that such paroxysms may be provocative of much mental distress, into labelling them as 'functional' or 'neurotic'. If a patient with chronic myocardial disease begins to be afflicted with attacks of respiratory distress, coming on chiefly at night, this is in itself a sign of impairment of the contractile power of the ventricle. It appears from recent work by Lewis and others that the actual cause of this type of dyspnoea is an acidosis dependent on deficient oxygenation of the blood. To accept this explanation affords a basis for the indubitable fact that the more extreme the dyspnoea the worse the prognosis. The writer has observed cases of chronic myocardial disease in which the approach of the end has been foreshadowed by the development of a periodic dyspnoea more or less continuous, and amounting in its intensity to a veritable air-hunger, in association with other evidences of acidosis—ethereal smell in the breath, vomiting and diarrhoea, delirium, and other nervous symptoms. As part of such a syndrome, the periodic breathlessness is as grave a feature as can be. Where heart-block

is present, various degrees of grouped disturbance of the respiratory rhythm may occur ; these are usually proportional to the degree of block present, and do not therefore furnish any index of the amount of impairment of contractility.

The significance of *cardiac pain* as a sign of defective contractile power has been fully considered under the heading of ANGINA PECTORIS, so that little time need be devoted to it here. Suffice it to say that the appearance of cardiac pain in any case of myocardial disease, whether the lesion be acute or chronic, is always a serious matter, because it portends inadequacy of the ventricles' power to contract. The actual importance of pain as a quantitative index of contractile failure is conditional on several considerations. First, how easily is it provoked ? Second, how easily is it relieved, particularly by vasodilators ? Third, what other evidence is there of myocardial disease ? Fourth, how severe is the pain ? The order of these questions is roughly that of their relative importance. Angina must always be regarded as a symptom and not a disease, significant from the prognostic standpoint not for its own sake but by virtue of that which it reveals.

A symptom which is held in great awe by the public as evidence of cardiac danger is the *liability to faint*. Now this view is certainly not supported by clinical experience, which shows that this particular symptom, so far from being an important sign of myocardial decadence, is rarely associated with cardiac disease at all. It is true that a man seized with an anginal attack will often faint as a result of the pain which he endures, and that the myocardial patient may die suddenly ; but apart from these two catastrophic types of faint, which are seldom foreshadowed by less minatory degrees of syncope, the cardiac patient is little if at all more prone to faint than the ordinary individual. There are, of course, the syncopal attacks seen in some cases of heart-block, but this syndrome is not often seen. Rarely the patient with an 'irritable' heart faints, but this is not due to myocardial disease. The fainting attacks of children, which have so often led to an unfortunate statement about a weak heart, are nearly always attacks of minor epilepsy, and have nothing whatever to do with heart disease.

Dropsy is an accurate index of impairment of contractility in disease of the myocardium, but it takes a little time to develop, so that it is seldom in evidence in acute myocarditis. But in the chronic degenerations of the cardiac muscle it is an almost constant feature, in the later stages if not before. Its value as an indicator of failing contractile force is to be found by a consideration of the extent and depth of the œdema, its rate of development, and its behaviour under the influence of rest and other therapeutic measures. In this connection it is well to remember two things. First, nothing but actual personal examination of the patient's ankles and lumbosacral region should suffice to convince one as to the presence or absence of œdema ; and second, the word 'dropsy' is very alarming to many patients, and should therefore be avoided as far as possible. There are also two fairly obvious precautions to observe before attributing œdema to cardiac disease. First, every means must be used to assure oneself that it is not a renal dropsy, and this should comprehend thorough examination of the urine, including microscopic examination of the centrifuged deposit. Second, the possibility of some associated cause of œdema, such as varicose veins or fibroids of the uterus, should not be forgotten. Even after all precaution has been exercised, however, it is sometimes impossible to determine whether œdema is partly, mainly, or wholly cardiac ; or whether it does perhaps owe its origin to coincident renal or other disease. When such difficulties arise, the importance of œdema as a quantitative index of loss of contractility is to some extent discounted, and we must be content to assess our patient's future fortune by such other means as are at our disposal.

The *daily output of urine* shrinks with failure of contractility, and increases again under successful treatment. Whenever possible this must be accurately measured and charted. There are few symptoms of more definite prognostic value than this in cases of myocardial disease that have reached the stage at which rest in bed and continuous observation are necessary.

A symptom which may appear near the end, especially in cases of acute myocardial damage, is *vomiting* ; it is not uncommon in the severe forms of cardiac rheumatism and diphtheria. In such cases it is nearly always associated with other evidences of approaching cardiac failure, and is a sign of the very gravest significance. In diphtheria,

the children who vomit usually suffer from epigastric pain, and display a *bruit de galop*, the majority dying within two or three weeks of the onset.

The *pulse* furnishes two useful indications of contractile failure. The *alternating pulse* and its prognostic import are discussed in the article on PULSE, IRREGULARITIES OF, but here its paramount importance as a sign of failing contractility must be insisted on. Although it is true that people may live for years after this type of variation has been first noticed, yet it is always a mark of grave myocardial degeneration. The other pulse change which argues the same thing in a person whose heart muscle is diseased is *progressive quickening*. If there is no extrinsic factor, such as pyrexia, to explain this away, it is an ominous proof of increasing incompetence of the ventricular wall to perform those vital duties that are expected of it. In an adult with myocardial disease, a pulse running persistently at over 120 per minute is a signal of immediate danger.

Among the *physical signs* indicative of contractile failure, there are two that are of some prognostic value. The first of these is perhaps seldom appreciated at its true value—*weakening of the cardiac sounds*. In acute rheumatic heart disease, for example, it is almost possible to measure the unhappy progress of the myocardial enfeeblement by the softening of the first sound at the apex; in the great majority of the cases of this description where a pericardial rub is or has been heard, weakening of the first sound at the apex is a sign of severe myocarditis, and not of pericardial effusion. In the other acute infections, such as typhoid fever, it may be almost the only indication of approaching ventricular failure. Of course, the intensity of the first sound varies widely according to the thickness of the chest-wall and other factors, in which different individuals differ widely from each other; so that it is not safe merely to compare the heart sounds of any one person with an imaginary general standard. The comparison should rather be between the first sound at the apex and the second sound at the base, or between the sounds as heard on one day as compared with their intensity a day or two later. For this purpose the Bock differential stethoscope is found useful by some clinicians. At the same time it is legitimate, and indeed highly necessary, to recognize the prime importance of feeble heart sounds in a person with average thoracic walls, in a case of myocardial disease.

The appearance of the *gallop rhythm* points in the same direction. In saying this one does not of course include the cases, common in childhood, in which a close imitation of the true *bruit de galop* is produced by a combination of reduplication of the second sound with rapid action of the heart. True gallop rhythm is always a sign of ventricular inadequacy, one of those valuable hints which must be interpreted as serious even when there is little collateral evidence to support such an interpretation. To exemplify this point: a few years ago a woman came into the writer's out-patient room complaining only that she felt run down. Examination of the chest disclosed the presence of a *bruit de galop*, and the urine was found to be that of subacute nephritis. Chiefly on the strength of the gallop rhythm, the woman was strongly urged to come into the hospital, but she postponed her decision; within a week she died suddenly. And this sign is ominous when it appears in cases of acute infective disease. One does, it is true, come across cases in which recovery ensues even though there has been a gallop rhythm; but such are the exceptions.

Finally, certain *changes in the lungs* portend a speedy dissolution, because they are also evidence of waning contractility. Of these, two stand pre-eminent—*acute pulmonary œdema* and *infarction of the lung*. The former is an almost constant feature of the last phase in cases of acute rheumatic carditis doomed to early death. Infarction is more often recovered from than acute œdema. *Hydrothorax* is also a bad feature of a case of chronic myocardial disease, partly because it proves a weak muscle, and partly because it adds a new embarrassment to the act of respiration. A sign of approaching cardiac failure to which Mackenzie has drawn attention is the development of *fine crepitations at the bases*. This, if looked for, is a valuable forewarning of difficulties, which may be averted by timely insistence on a period of rest. As Morison points out, these crepitations appear and disappear according to the patient's changes of posture, always appearing in the most dependent part of the lung.

All these phenomena owe their serious import to the fact that they arise from impairment of the contractile force of the ventricles, the very thing for which the heart has

been evolved and on which life depends. *The gravest generalization that can be made about any case of primary myocardial disease is that there is evidence of failing of the contractile force of the ventricles.*

Impairment of Tonus.—As to the other myocardial functions, it may seem a splitting of straws to differentiate between contractility and tonus, but so far as prognosis is concerned there is certainly a difference, if we regard as signs of lost tone the appearance of a systolic murmur of mitral incompetence, and ventricular dilatation. Many a case of cardiosclerosis in which there are most definite and threatening signs of exhausted contractility goes on to the end with little or no dilatation. Indeed, in such cases the appearance of a mitral systolic murmur, denoting failure of tone in the muscular tissue of the auriculo-ventricular ring, may be attended by actual relief of the symptoms, possibly because the overtaxed ventricle is thus freed of some of the mass of blood to be lifted by each systole. Each of these phenomena, ventricular dilatation and mitral incompetence, demands separate and detailed consideration.

The important aspect of *dilatation*, so far as prognosis is concerned, is its course rather than its extent. Rapid stretching of the ventricle in acute disease is an untoward feature, because it proves that the muscle is thoroughly saturated with poison; but it carries no immediate threat of dissolution, unless there are simultaneous signs of impaired contractility. In acute rheumatic carditis, for instance, it is remarkable how large the heart may become without remaining so permanently or killing the patient. Even in so insidious a disease as cardiosclerosis, acute dilatation may prove temporary, though of course this is exceptional. Generally speaking, the more rapid the enlargement of the heart, the worse the prognosis. Again, it will go worse with the patient if dilatation persists in spite of treatment, for two reasons: because it argues profound injury to the cells of the cardiac wall, and because a permanent increase in the cubic content of the ventricle imposes a correspondingly increased burden of blood for the ventricle to lift at each systole.

As to the *mitral systolic murmur* that so often makes itself heard in primarily muscular cases of heart disease, there can be no question that in such it owes its origin to a fall in the tonicity of the muscle which forms part of the mitral ring. What, then, is its prognostic significance? It is remarkable to find how close an agreement there is as to its unimportance—whether in the chronic or in the infective lesions of the myocardium—among those who have made a systematic study of the point. The only weight it can be said to carry is that it sometimes serves to confirm a diagnosis of heart disease that would otherwise rest on suspicion only. In diphtheria, White and Smith, of Boston, U.S.A., who made a statistical study of nearly a thousand cases, found that the presence of a systolic bruit at the apex added nothing to the gravity of the prognosis, even when the murmur persisted long into convalescence. Over and over again Mackenzie and other systematic writers on myocardial decay have of recent years insisted on the same fact, that a mitral systolic murmur adds nothing to the gravity of the case. Again, the loudness of an apical bruit is no criterion of the seriousness of the case, except, perhaps, in the direction opposite to that which might at first seem obvious, for it is certainly reassuring to discover in what looks otherwise like a very severe case, say, of cardiac diphtheria, a loud murmur at the apex. In such a case we accept it as welcome proof that the heart still possesses some contractile force. Finally, it is a mistake in treatment to keep patients in bed after acute illness until the murmur which it has caused has disappeared. It may persist for weeks or months, and such long confinement to bed does the patient far more harm than good.

Disturbances of the Other Functions of the Cardiac Muscle.—The rhythmic production of stimuli, the capacity for excitation by those stimuli, and the function of conductivity are all considered fully in the article on PULSE, IRREGULARITIES OF.

There are two types of irregularity that do not matter—*sinus irregularity* and *extrasystoles*—the latter being so common in cardiosclerosis as to be almost the rule. It is well worth while to realize the relative insignificance of the extrasystolic type of arrhythmia; many an elderly man is needlessly and indeed hurtfully “cabined, cribbed, confined” in his activities by a medical attendant who is frightened by discovering that the pulse is irregular, without perceiving that the irregularity is of the unimportant kind.

Paroxysmal tachycardia has rather more significance, for on the one hand it proves the existence of an abnormally irritable focus in the diseased heart wall, while on the other it adds the burden of excessively rapid work to that which the imperfect ventricular muscle can barely undertake. This extra stress reveals itself during the attacks in several ways ; the heart becomes rapidly dilated, the legs may swell, the patient is cyanosed and distressed, and the pulse may even become alternating. The gravity of the outlook is obviously enhanced in any given case of myocardial disease when there occur paroxysms of tachycardia with such dire effects ; and their serious import is to be measured in terms of the readiness with which each attack exhausts the heart. Information as to this is yielded by observation of the behaviour of the heart during the paroxysm, and also by its condition after the attack is over.

The condition of *auricular flutter* is transitional, both in nature and importance, between that of paroxysmal tachycardia and that of auricular fibrillation ; probably its worst possibility is that it may pass over into the latter. Fortunately it seems often to yield to digitalis.

The *totally irregular pulse* of *auricular fibrillation* is always an unwelcome feature of myocardial disease, whether acute or chronic. It means that the cardiac muscle has reached a certain point in its downward career, from which it can never recover permanently. Patients with primary muscle disease of the heart who develop this type of arrhythmia fare worse than those in whom it constitutes a late phase of chronic mitral disease ; in the former, the ventricle is less able to cope with the rapid irregular stimuli handed down to it by the auricle than in the latter, for the cells of its wall are already barely fit to carry on their systolic task. Much depends in this, as in auricular flutter, on the response of the heart to digitalis treatment, which should receive a proper trial before a bad prognosis is arrived at ; if a course of full doses of this drug, given under suitable conditions, fails to relieve the dyspnoea and slow the pulse, then the prognosis is indeed gloomy. Hay points out that the reaction of the heart to the new rhythm (or want of it) should be observed ; by this means some gauge of the ventricle's capacity to stand the strain will be forthcoming. He also remarks that those cases in which the irregularity and its attendant disabilities come on suddenly and without premonition do worse than those in which the onset is more gradual. The majority of myocardial decadents do not survive the onset of this irregularity for more than three years.

The presence of signs of *interference with the conduction of impulses from auricle to ventricle* (lengthening of the *a-c* interval, heart-block of various grades) adds to the severity of the prognosis ; and the greater the degree of interference the more is this the case. The presence of heart-block in any case of cardiac disease proves that there is a gross lesion of the deep myocardium. In acute infective disease this block nearly always turns out to be transient, so that it does not warrant a gloomy view of the case on its own account ; but in the chronic myocardial degenerations it is otherwise, for here the lesion of conductivity is nearly always progressive or at least permanent, and, except in some syphilitic cases, it is not influenced by treatment. Even so, however, an absolutely bad prognosis is not warranted ; for on the one hand the heart-block may interfere but little with the efficient emptying of the ventricles in systole, while on the other there is always just a chance that it may pass off after an undeterminable interval and reappear no more. It is always important not to allow the heart-block to make one forget the other features of the case ; for the prognosis depends on a reasonable consideration of the state of all the cardiac functions, and the influence of all the disturbances encountered on the power of the heart to carry on the circulation in an efficient manner.

The Likelihood of Sudden Death in primary disease of the myocardium depends on two things. It may occur as a result of rupture of the cardiac wall or gross interference with a part of the myocardium due to thrombosis or embolism ; or it may much more commonly result from an exhaustion of the contractile power of the ventricular muscle. We are forewarned of the former type of possibility by *pericardial friction* or rapid enfeeblement of the heart's action, especially if it follow close on the heels of an anginal attack. Attacks of this kind—anginal pain, rapid weakening of the cardiac sounds, with pericardial friction—occurring in cases of chronic myocardial disease, warrant the gravest prognosis. The majority of such cases terminate fatally within a few days ; and even if he survive, the patient's future career must be guarded with the utmost care. The

evidences of failing contractile power have been fully described above, and it need only be repeated that the chief end of the heart is to contract efficiently, so that anything which suggests an encroachment on this function is a grave feature of the case. The whole art of prognosis in heart disease lies in the ability of the physician to discover whether this power is threatened or not.

The Influence of Treatment on prognosis is unhappily small, apart from those points that have already been mentioned by the way. Some writers claim that the systematic use of certain drugs, camphor for example, and also cane sugar, will lengthen the life of a degenerate myocardium. Possibly there is a value in these measures, but this cannot be stated in definite terms, at all events at present. The lines along which most preservation of life is to be effected in these cases are (1) Grappling with the cause; and (2) Saving the heart from overstress, especially of the sudden type.

Carey F. Coombs.

MYOPATHIES.—(See MUSCULAR ATROPHIES.)

MYOPIA.—This condition, if of moderate degree which can be corrected by lenses, is little or no disability. When the myopia is of high degree (about -10 D or more), the correcting lenses are heavy and clumsy, the field of vision is restricted, the vision often cannot be brought up to the normal acuity, and there is liability to grave complications.

Causation.—Only axial myopia, or that due to elongation of the eyeball, will be considered. At birth, the eye is hypermetropic to the extent of 1 to 8 dioptries, usually 2 or 3 dioptries. The eyes grow with the growth of the child, and between the ages of 6 and 12 about 75 per cent of eyes become approximately emmetropic. If the eyes grow beyond the point required to make them emmetropic, a benign form of myopia is produced. This is a form in which the myopia increases slowly until the age of 16 to 20 years is reached, when it ceases to increase, and the eyes undergo little or no subsequent change. The degree of myopia usually does not exceed 5 dioptries, the visual acuity can be brought to the normal with lenses, and the fundi show no departure from the normal. These patients usually have a family history of myopia, and one may find some members of the family remaining hypermetropic, while others, with similar astigmatism, develop into myopes.

In the great majority of myopic eyes there is stretching of the posterior half of the eye, the sclera at the posterior pole becoming thinner than normal, and, in the higher degrees of myopia, extremely thin.^{1 2} This stretching has given rise to a great deal of discussion.³ It is generally agreed that the greatest factor in its production is the increased pressure exerted on the eyes by the extrinsic muscles when converging and looking down (*see below*, 'Occupation'). The fact of the stretching being in the posterior half may be explained by the anterior half being surrounded and supported by the muscles. *Stooping and straining*, especially when a tight collar is worn, may be factors in causing myopia to increase. Edridge-Green⁴ believes strain to be the chief factor in its causation, but he is not supported in this by the majority of ophthalmologists.

Heredity (*see below*) is a predisposing factor in the majority of cases. Probably what is inherited is a weak sclera, which gives way under pressures which the normal eye resists.

It is not uncommon to find myopia developing after an attack of measles, less common after typhoid fever and other debilitating illnesses. In these cases it is difficult to decide how far the myopia is to be attributed to the disease, and how far to excessive reading in bed in a pernicious attitude during convalescence. In congenital syphilis myopia develops as a complication of interstitial keratitis (q.v.) in about one-third of cases.

Conditions affecting Prognosis.—

Age.—The younger the patient when myopia first develops, the more likely is it to increase rapidly, and to reach a high degree. The grave complications of myopia, macular degeneration and detachment of the retina, are rare before the age of 30, and their frequency increases greatly after 50. The popular idea that myopia improves with age is a fallacy, and is probably based on the observation that myopes are often able to read print without glasses at an age when persons with normal eyes have to use convex lenses to correct presbyopia. Any improvement in distant vision with age is due to senile myosis cutting off diffusion circles, as a pinhole does.

Sex.—Myopia is commoner in females than in males, and after the age of puberty the disparity is more marked. The higher degrees of myopia are far commoner in women, as are the complications of high myopia. Degeneration at the macula is twice as common in females, and it occurs in lower degrees of myopia than in males. It is rare to find macular degeneration in a man with myopia lower than 10 dioptries, whereas in women it is met with at 6 dioptries.

Heredity.—Many investigations have been made as to the frequency with which myopes have a family history of myopia. Considering the difficulty of examining all the members of families on a sufficiently large scale, it is not surprising that the statistics vary greatly. Hirschberg reported 455 cases of myopia exceeding 6 dioptries with an hereditary tendency in 69·7 per cent. Sattler⁵ reported 60 cases of myopia exceeding 10 D, with heredity in 50 per cent. Motais⁶ made a very thorough investigation on the point, examining 1991 eyes, and states that 65 per cent of all cases of myopia show heredity. Several authors have published statistics to show that when myopia is inherited it is of the benign, non-progressive type; but that must not be pressed too far, as some of the worst cases of progressive myopia have myopic parents. Priestley Smith⁷ sums up the position on this point, saying “it is better to have a myopia inherited from one’s parents and an otherwise sound organism, than a myopia acquired for oneself by reason of debility or disease”.

Occupation.—It has already been stated that the chief exciting cause of progressive myopia is *convergence and looking down*. Hence myopia is common among students, clerks, needlewomen, and others engaged in fine, close work. Jewellers are liable to become myopic, whereas watchmakers, who use one eye only, are not.

Hertel⁸ examined the incidence of myopia in 7292 cases, and grouped them in three classes according to the work on which they were engaged. He gives the following figures :—

Peasants -	-	-	-	-	21·3 per cent of myopia
Manual workers in coarse work	-				26·3 “ “
Students and workers in fine trades	-				51·6 “ “

Reading at too short a distance is a habit with many people, and is almost universal, unless checked, in children. *Insufficient illumination* increases the tendency to read and work too close. Much may be done to check myopia by making children read at a sufficient distance (13 to 15 inches), sitting upright, with the book propped up or on a sloping desk. Myopic children are great readers. Finding that their eye defect prevents their competing on equal terms with their fellows in out-door games, they seek their recreation in reading.

Effect of Correcting Lenses.—Until recently, most ophthalmologists were impressed with the idea that excessive *accommodation* was responsible for increase of myopia, and made a practice of ordering lenses which under-corrected the myopia. In the higher degrees they ordered lenses 3 D under the full correction, so that the patient might read at 33 cm. without using his accommodation.

If a young myope is given lenses which under-correct his error, he does not relax his accommodation and read at full distance, but, keeping up a certain amount of ciliary tone, finds that with the glasses provided for him print is indistinct at the proper distance, and brings it closer to his eyes until he can see it clearly. In this way a habit of reading at too short a distance, with the attendant evil of over-convergence, is formed or perpetuated. The tendency now is to give young myopes a full correction of their error, including any astigmatism, and to insist on their reading at full distance. Sulzer⁹ reports 16 cases of myopia which was rapidly increasing with under-correction and was arrested by giving full correction of the errors. Risley¹⁰ reports the results of a collective experiment on this point made in Philadelphia. In that city, until 1872, the practice was to under-correct myopia. In that year, the ophthalmologists agreed to order for their patients lenses fully correcting their myopia, and 20 years later the records of their refraction cases were analyzed. It was found that both the frequency and the degree of myopia diminished. In the first decade the proportion of myopia to other errors of refraction was 28·43 per cent, in the second decade it was 16·78 per cent. Over the same period, sales of concave lenses by opticians in Philadelphia showed a similar diminution, from

25.4 per cent in the first decade, to 15.2 per cent in the second. Also fewer concave lenses over 10 D were required.

Condition of the Fundus Oculi.—In low degrees of myopia it is not unusual to find a perfectly normal fundus. In adults with over 6 D of myopia, *myopic crescents* are almost invariably present. When the crescent is narrow, and limited to the temporal margin of the disc, it does not indicate that the myopia is progressive; such crescents occur, indeed, in emmetropic and hypermetropic eyes. A wide crescent, extending year by year towards the macula, or encircling the disc, suggests a grave, progressive myopia; but there is not a constant relationship between high degrees of myopia and extensive crescents.

Thinning of the choroid at the posterior pole indicates a progressive myopia. This is usually seen as a bleaching of the choroid, either in a sharply-defined area on the temporal side of the disc or over the whole papillomacular area.

Changes at the Macula.—These are the chief causes of defective vision in high myopia. They are rare in low degrees, and increase in frequency with the degree of myopia. They are degenerative changes in the choroid. In the slightest cases there are minute pigmented spots, which produce an appearance of stippling at the macula. In other cases the macula is depigmented, or is occupied by a spot of pigment. In these cases there is great deterioration of vision.

Detachment of the Retina.—This is the gravest complication of high myopia. Hertel⁸ states that it occurs in 0.96 per cent of all cases of myopia, and is four times as common in myopes as in hypermetropes. It is very rarely met with in myopia of less than 12 D. There are two symptoms which sometimes give warning of approaching detachment of the retina. These are *metamorphopsia* (distortion of objects gazed at) and *photopsia* (sparks or flashes of light). If the patient is warned of the significance of these symptoms, it is sometimes possible to avert the threatened detachment.

TREATMENT of this condition is not very successful. The most promising method consists in trephining the sclera and evacuating the sub-retinal fluid. Re-attachment occurs in perhaps 10 per cent of cases, but useful vision is not restored in all of these.

Changes in the Vitreous.—Congenital opacities in the vitreous ('*muscae volitantes*') occur in perfectly healthy eyes. In myopia they are more readily seen by the patient, and are commonly complained of. If few, and not increasing in number, they are of no importance. They are less obvious if the error of refraction is corrected. Numerous and increasing vitreous opacities indicate choroidal degeneration and fluidity of the vitreous, and are a grave sign in proportion to their number and the freedom with which they move on movement of the eye.

Operative Treatment of Myopia.—If in a myope of about 20 D the crystalline lens is removed, the eye becomes approximately emmetropic. This operation is rarely performed in this country. It is more favourably regarded in America, and is frequently performed in Germany. The object of the operation is to improve vision, enabling the patient to see clearly with weak lenses, or with none. The operation is reserved for cases of myopia of 16 D or more in adults, and of 10 D, which is increasing, in children. The usual operation is discission, but Sattler (loc. cit.) advocates extraction of the lens. The effects of the operation are purely optical: it does not appear to arrest progressive myopia or to prevent complications. Of 75 cases operated upon by Haab¹¹ and examined two years or more after the operation, in 57 the vision was improved, in 2 there was no change, in 8 the vision was worse, and in 8 the eye was blind. Detachment of the retina occurred in 5 per cent of Haab's cases. Hertel (loc. cit.) states that detachment occurs in 9 per cent of cases of myopia after removal of the lens, and compares this with the frequency of detachment in myopes of 20 D not operated upon, which is 4 per cent.

REFERENCES.—¹Heine, *Arch. f. Augenh.* 1898, xxxviii; ²Baas, *Ibid.* 1892, xxvi; ³Parsons, *The Pathology of the Eye*, London, 1904, iv, 922; ⁴Edridge Green, *Arris and Gale Lecture*, London, 1921; ⁵Sattler, Bowman Lecture, *Trans. Ophthalmol. Soc.* 1907, xxvii; ⁶Motais, *Ann. d'Oculist.* 1889, viii; ⁷Priestley Smith, "Discussion on Pernicious Myopia", *Brit. Med. Jour.* 1901, ii, 1162; ⁸Hertel, "Ueber Myopie", *Arch. f. Ophthalmol.* 1903, lvi, 326; ⁹Sulzer, "Quelques faits relatifs au développement de la Myopie", *Ann. d'Oculist.* 1894, cx, 15; ¹⁰Risley, "The Result of Treatment and Optical Corrections in Arresting the Progress of Myopia", *Trans. Amer. Ophthalmol. Soc.* 1894, 168; ¹¹Sidler-Huguenin, *Ophthalmoscope*, 1906, Sept.

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MYOSITIS OSSIFICANS.—Two conditions pass under this title, the one a generalized slow ossification of muscles all over the body, producing a so-called ‘brittle man’, and the other a newly-described disease in which, after a fracture, a mass of bone forms in the neighbouring muscles owing to dissemination of osteoblasts.

Generalized Myositis Ossificans is rare, lasts about ten or twelve years, and shows alternate periods of advance and arrest. It always ends fatally, the termination being usually due to pulmonary troubles from fixation of the chest.

Traumatic Myositis Ossificans has only come into prominence since the introduction of massage and movements in the treatment of fractures, and the use of skiagraphy for diagnosis. The commonest site for the mass of bone is in the substance of the brachialis anticus after an injury of the lower end of the humerus or dislocation of the elbow. The writer has seen it in the gastrocnemius in association with fracture of the condyle of the femur, and in the crureus after fracture of the shaft, or, in one case in a public-school boy, after a simple hæmatoma of the quadriceps. The hard mass in the muscle can be moved upon the underlying bone. It usually appears some weeks or months after the original injury, and may cause severe limitation of movement.

The prognosis depends to a considerable degree on the treatment. Early removal by operation usually leads to recurrence, and no benefit is obtained. During the first few weeks or months, absolute fixation with a plaster case or splint appears to give the best results. After the ossification is complete and the bony mass has settled down, it may be removed, but not until several months have elapsed.

Schulz gives the German Army figures for the years 1897–1907. Ninety-nine were operated on, of whom 26 per cent were invalided out of the army; 313 were treated by splints, etc., of whom 16·6 per cent were invalided out. It must be remembered, of course, in comparing these figures, that naturally the worst cases were treated by operation.

When the original injury affects the joint, the outlook is much graver than when the bone was broken. Thus, of cases operated on for this form of myositis ossificans by Chabrol, there were 95 bone injury cases, of which 77 were cured, 15 better, 3 no better; and 25 following dislocation, of which 8 were cured, 8 better, and 9 no better. It will be wise, therefore, to trust to rigid fixation in the dislocation cases.

The time occupied by the treatment varies, but is seldom less than three months, and may be much longer.

REFERENCE.—Lapointe, *Rev. de Chir.* 1912, 657.

A. Rendle Short.

NASAL ACCESSORY SINUSITIS.—The risk to life in suppuration of the accessory sinuses, whether acute or chronic, is only slight. In more than 25,000 post-mortems, such suppuration was the cause of 18 deaths, while in the same series aural suppuration was responsible for ten times that number.¹

Acute cases usually resolve, either without any treatment, or with minor operative measures. Such resolution may be delayed for weeks or months, and then take place without operation.

Measures applicable to all sinuses, both with and without operation, are the injection of vaccines and the local injection of *bismuth paste*.

Vaccine Treatment.—In acute cases, vaccines are usually contra-indicated. The following results were obtained in chronic cases; in the majority, however, some operative measure was also employed:—

RESULTS OF VACCINE TREATMENT IN CHRONIC NASAL ACCESSORY SINUSITIS.

Reporter	Cases treated	Improved	Cured
Harmer ² - - -	41	14	0
Logan Turner ² - -	5	2	0
Allen ³ - - -	30	20	0
Birkett ⁴ .. - -	4	0	0
Levy ⁴ - - -	15	6	6
Patterson ⁴ - - -	11	1	4
Brawley ⁴ - - -	10	4	3
Total -	116	47 (or 40 per cent)	13 (or 18 per cent)

All of the cases reported as cured had been recently operated upon, so that it is impossible to say how much credit should be given to the vaccine.

Vaccines are useless as a substitute for operation. They may be of some slight help afterwards, but even this is not certain.

Bismuth Paste.—Injections of this paste into the diseased sinus, as advocated by Beck,⁵ may hasten cure after operation, but, like vaccines, they are not a substitute for it.

We shall now proceed to consider the results of the operative treatment of each sinus in detail.

Maxillary Sinus.—The majority of acute cases resolve, even without treatment. Complications are rare, and fatalities are almost unknown. Treatment consists in washing out of the cavity through the inferior meatus with trocar and cannula, combined with the application of vasoconstrictors to the nasal mucosa to promote drainage. Recovery, in a really acute case, is almost certain under treatment.

Chronic cases seldom, if ever, recover spontaneously. The treatment is operative, and alternative methods are: (1) Nasal puncture and lavage through trocar and cannula; (2) Alveolar drainage; (3) Intranasal operation (Claoné); (4) Radical operation through the canine fossa (Caldwell-Luc).

1. *Nasal puncture and lavage through trocar and cannula* is an unsatisfactory method in chronic cases. A cure can sometimes be obtained, but only if the puncture is repeated a large number of times. Thus, Koenig and Mahu⁶ record cases cured by twenty-seven and fifty-four punctures respectively. The majority of patients, however, would object to so many repetitions of any operation, even if very slight.

2. *Alveolar drainage*, by the insertion of a tube through a perforated tooth-socket, with subsequent washing out, was formerly the accepted method. A fair proportion of cases can be cured by this means. Tilley,⁷ out of 27 cases, obtained a cure in only 5, whilst Logan Turner⁸ records cure in 62 out of 113 cases, a total percentage of 47.

3. *The intranasal operation* consists in making a large opening into the antrum through the inferior meatus of the nose. The results are better than those of the alveolar operation. Logan Turner⁸ records 44 cures in 55 cases treated, Goning⁹ 21 in 23, Rethi¹⁰ 90 in 100, and Parker¹¹ 12 in 15, altogether over 80 per cent of cures. Claoné,⁹ the originator of this operation, claims that it will cure 80 per cent of cases.

4. *The radical canine operation* consists in making a free opening into the cavity through the canine fossa, curetting the lining membrane if necessary, and then making a free opening from the antrum into the nose. This operation is the most certain in its results. Tilley gives 34 cures out of 37 cases, and Logan Turner⁸ 12 out of 12. Cure will be obtained from this operation in something over 90 per cent of cases. Objections to it are the fact of its being a more severe operation than any of the others, the occasional post-operative neuralgia or anæsthesia from injury to the infra-orbital nerve, and the anæsthesia of teeth from the division of the nerves supplying them.

To sum up: Repeated nasal puncture and alveolar drainage are unsuitable, the former because of its uncertainty and necessity for repetition, the latter because a cure is not obtained in more than half the cases. In favour of the intranasal operation is the fact that it is a slight one, and can, if desired, be performed under local anæsthesia. The canine operation gives a better chance of cure (over 90 instead of 80 per cent), but it is more severe, and more likely to give rise to troublesome sequelæ.

Logan Turner¹² has shown that cases with an excess of lymphocytes in the discharge are more resistant to treatment, and should therefore have the more radical operation.

Frontal Sinus.—Although fatalities are rare, they occur more often in affections of this sinus than of any other. The risks are either an intracranial infection (abscess or meningitis), or infective osteomyelitis of the cranial bones. Acute cases, in the absence of complications, are readily cured by intranasal treatment. Coagley,¹³ in a total of 58 cases, obtained a cure by intranasal methods in 54, or 93 per cent; 2 cases died, or 3.4 per cent. This is probably a higher rate of mortality than the normal, only the more severe cases getting to the specialist for treatment.

Chronic cases are very much more difficult to cure; but the mortality, apart from operation, is very slight. Treatment is operative, and the alternatives are: (1) Intranasal methods to improve drainage and allow of washing out; (2) One of the many varieties of external radical operation.

1. *The intranasal method* consists in a partial or complete removal of the middle turbinal bone, and opening of the portion of the ethmoidal labyrinth which is in relation to the nasal opening of the sinus. The operation has only recently been used to any large extent. Coagley,¹⁴ from an experience of 79 cases, records 14 per cent cured, and 51 per cent improved. Gruner¹⁵ gives 16 cures out of 18 cases. Ingals,¹⁶ from an experience of 39 cases, concludes that a cure can be obtained in 95 per cent. Watson-Williams¹⁷ has operated on 48 cases, with cures in about 50 per cent, and 1 death. Tilley,¹⁷ in an experience of 30 cases, has obtained cure or relief in "a majority of them". Thus, the operative mortality in these 216 cases is only 0.46 per cent. If by cure is meant freedom from all discharge, as well as relief from symptoms, it is only obtained in a minority of cases. Probably from 50 to 75 per cent are relieved from all troublesome symptoms.

2. *The external radical operation*, as exemplified by the Killian method, aims at obliteration of the sinus. It was performed much more frequently a few years ago than at present.

RESULTS OF EXTERNAL RADICAL OPERATION FOR FRONTAL SINUSITIS.

Reporter	Cases treated	Cured	Improved	Died
Lindt ¹⁸ - - - -	21	11	8	1
Horn ¹⁹ - - - -	28	22	6	0
Hosca ²⁰ - - - -	34	32	—	2
Watson-Williams ²¹ - -	28	11	15	0
Marshik ²² - - - -	54	—	—	3
Von Eicken ²³ - - -	100	—	—	3
Total	265	—	—	9 (or 3.4 per cent)

Thus, out of 265 cases, the mortality from the operation was 3.4 per cent. In 111 of them in which the result is recorded, a cure was obtained in 67 per cent, and improvement in 26 per cent. In addition to the risk to life, the external operation always gives rise to more or less deformity, and may be followed by complications. Skillern,² in a review of his 20 cases, has found some unpleasant after-results in nearly all, ranging from paralysis of the upper lid and anæsthesia of the forehead, to blindness on the operated side from injury to the optic nerve.

To sum up: In the presence of such complications as orbital abscess, the external operation is essential. In other cases, the intranasal operation, with a mortality of about 0.5 per cent, will relieve symptoms in some 50 to 75 per cent, and has no unpleasant sequelæ. The radical external operation has a mortality six times as great, gives rise to deformity and other complications, but will ensure relief or cure in 80 to 90 per cent of cases.

Ethmoidal and Sphenoidal Sinuses.—Suppuration of either sinus may cause death by meningeal involvement; or, in the case of the sphenoidal sinus, by a septic thrombosis of the cavernous sinus. Either event is rare, but StClair Thomson²⁴ has collected 40 deaths as a result of sphenoidal sinusitis. Both conditions usually occur together and associated with suppuration in the frontal sinus and antrum.

A cure will usually result when the cavities are freely opened intranasally; but, in the case of the ethmoidal cells, anatomical conditions sometimes prevent this being satisfactorily performed without undue risk.

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NEPHRITIS. (*See also* ALBUMINURIA ; URÆMIA.)

Acute Nephritis is always a serious disease which demands a guarded prognosis ; yet there is a natural tendency to recovery, and in many cases recovery does take place, with apparent return to normal kidney function. Some authorities hold, however, that complete recovery is more apparent than real, and that a kidney, once attacked with acute inflammation, is left permanently weak and liable to recurrence of inflammatory disease : this is particularly well illustrated in the case of scarlatinal nephritis. In considering prognosis in a given case, the first essential is to establish the diagnosis of acute nephritis, and to eliminate the existence of an acute exacerbation in the course of a subacute or chronic nephritis. Diagnosis may be easy in private practice, if the physician is familiar with the patient before the onset of his illness ; but when seen for the first time during the attack, diagnosis may present difficulties. An acute onset, with possibly some fever ; a urine small in amount, of high specific gravity, containing copious albumin, blood, and numerous tube casts ; an absence of definite cardiovascular changes : these point to an acute nephritis. If cardiovascular changes are recognizable, the physician is bound to suspect the existence of an acute exacerbation in the course of a chronic nephritis. An estimation of the quantity and specific gravity of the *twenty-four hours* urine will, at times, give assistance. If the amount be about the normal, and the specific gravity a little low, an underlying chronic condition should be suspected, and a guarded prognosis given. Unfortunately for diagnosis, acute nephritis does not always show the frank onset as given in the text-books, but may begin insidiously, and be only discovered when its existence for some time has led to feelings of ill-health, and on examination of the urine the presence of albumin and blood is discovered. In such cases, the diagnosis is often difficult, and the ultimate prognosis does not seem to be so favourable as when the onset is sudden and frank. The patient's history may aid by putting the physician on his guard : previous headache, polyuria, frequency of micturition at night, point to a chronic lesion. In health, as is well recognized, the amount of urine secreted during the twelve hours of day is three to four times the amount of that secreted during the twelve hours of night. In certain diseased conditions, and especially in chronic nephritis, this ratio is altered, and the quantity of night urine may equal, or even exceed, the quantity secreted during the day. This leads to a complaint of frequency of micturition at night, a complaint which may be one of the first symptoms for which advice is sought in chronic interstitial nephritis.

If the diagnosis of acute nephritis be established, what are the patient's chances of complete recovery, and what of the duration of the disease ? The statistics of the Royal Infirmary, Edinburgh, show that, during the twenty years 1900 to 1920 inclusive, 686 cases of nephritis, diagnosed as acute, came under treatment. Of these, 324 were discharged as cured, giving a percentage of cure as 47 ; while 262 were discharged as 'relieved', i.e., had passed into a subacute or chronic condition, with relief of symptoms, but liable at any time to a relapse, with an acute exacerbation of their chronic disease. The mortality in the 686 cases was 100, or 14 per cent. Such statistics, though they cannot be strictly applicable to nephritis in private practice, are, nevertheless, far from reassuring, and show how guarded the prognosis must be. In giving a prognosis, the practitioner is guided by the severity of the attack and the cause of the affection. Thus, the acute nephritis of scarlet fever, and the true acute nephritis of diphtheria, may be, and often are, very rapidly fatal. On the other hand, in a considerable number of cases of nephritis not consequent upon a recognized specific infection, the acute symptoms subside, the albuminuria may disappear, and the patient may be discharged as cured after an average stay in hospital of six weeks. Even then prognosis must be guarded ; for subsequent attacks are common, and the inflammatory affection does not clear up with the same facility on the second occasion. The principal factors which influence the prognosis during the acute stage are : the amount of urine which the kidneys are capable of secreting ; the condition of the cardiovascular system ; the presence or absence of uræmic symptoms and secondary inflammatory conditions.

When the *quantity of urine* is reduced to a few ounces of a highly albuminous, blood-stained fluid, or when there is complete anuria, prognosis is very grave. Complete anuria is said by some to be necessarily fatal ; but, while this is commonly true, it is not universally so, as cases are recorded, and it is the writer's experience, that recovery

may take place after from twelve to fourteen hours, or even more, of complete suppression.

The condition of the cardiovascular system merits careful consideration. A frequent, irregular pulse, with evidence of loss of myocardial tonicity, is always of grave import. The gravity of the condition will be accentuated if hæmaturia, or possibly hæmorrhage from the alimentary canal, has led to any considerable anæmia; in fact the presence of marked anæmia may turn the scale against recovery. Pericarditis is usually a terminal phenomenon, and is commonly of streptococcal origin.

Uræmia is a common cause of death, especially, according to Dickenson, in patients over sixteen years of age; in younger patients, inflammations of the respiratory tract are even more fatal than uræmia. Œdema of the lungs and of the glottis are very grave phenomena, which may appear with great suddenness, and prove fatal in a few hours.

The question of prognosis in acute nephritis is always difficult and uncertain. Most surprising recoveries may take place. Equally surprising and disappointing fatalities may occur, say, from a uræmic convulsion in a patient who, casually examined, does not appear to be in a critical condition. As with treatment, so with prognosis; every case must be carefully studied, considered on its own merits, and due weight given to the more important factors. Amongst other factors, consideration must be given to *response to treatment*. Favourable signs in the early stages are an increase in the quantity of urine and a diminution in the œdema; in the later periods, diminution in the albumin, blood, and formed elements in the urine, and a definite diuresis. When improvement is taking place, not only is there an increase in the quantity of urine and a diminution in the amount of albumin, but a change takes place in the character of the deposit: epithelial cells and free blood-corpuscles become less numerous, and epithelial and blood casts are gradually replaced by the hyaline and granular varieties. It has been suggested that some prognostic value can be attached to the size, and especially to the breadth, of the tube casts found in the deposit—large *broad* epithelial casts showing a profound desquamation of the tubules—but it seems very doubtful if reliance can be placed on this factor. At times, in the course of an acute nephritis, improvement seems to take place—albumin diminishes, the urinary quantity returns to about the normal—but the patient remains somewhat anæmic, a little œdema may be found about the eyes and ankles, the centrifuge shows the presence of granular and fatty casts, and, after a time, the radial artery becomes faintly palpable. Such a patient is passing into a condition of subacute diffused nephritis, and ultimate recovery seems doubtful. Particularly disappointing are cases where improvement is, at first, apparently rapid, the urinary amount returns to the normal, with only a trace of albumin, and casts are difficult to find, even with the centrifuge: yet, whenever the diet is altered from the minimum of protein and the maximum of carbohydrate and fat, a fresh exacerbation takes place, accompanied by hæmaturia. In such cases, the kidneys have been so damaged that they cannot undertake a reasonable amount of work, and the chance of ultimate recovery is not good. Yet, in acute nephritis, even when apparently of a hopeless character, there is always a chance of recovery, which encourages the physician to persevere in therapeutic measures. The writer well remembers the case of a young man who had been ill for two months. The urine was greatly reduced in quantity, and contained copious albumin, blood, and tube casts of all varieties. There was universal anasarca, so marked as to require draining: Southey's tubes were introduced into the legs, and a trocar into the abdomen. For five days the patient lived on a nitrogen- and chloride-poor diet, and passed most of his time seated on the edge of his bed with the feet dependent, draining continuously, the tubes being changed from time to time. With the disappearance of the œdema there was relief of the circulation, the rested kidneys regained their functional activity, and within a few months the patient passed an Army Board for a commission in India.

One may sum up experience, then, by saying that in acute nephritis prognosis must always be guarded; recovery may take place even in apparently hopeless cases; but a considerable proportion of the sufferers pass into a subacute or chronic condition, with interstitial and cardiovascular changes, from which complete recovery never takes place. (See also SCARLET FEVER.)

Chronic Diffused Nephritis is very justly looked upon as a grave condition, the prognosis in which is bad. Cases are recorded where recovery has taken place; but there always remains the doubt if the line had been sufficiently drawn between a somewhat persistent form of acute nephritis and a true chronic diffused nephritis. The fatal issue may occur in from six months to two years, and may result from general exhaustion, with pronounced anæmia. These patients frequently exhibit profound alimentary disturbance, and can neither take nor assimilate sufficient nourishment. Frequently there is failure of the myocardial tonicity, with dilatation and pronounced anasarca. Uræmia, in its protean manifestations, or pneumonia, may prove the terminal feature; or an infective process, resulting in an inflammation of a serous membrane.

Prognosis will always be grave, but certain features will help in assessing the gravity. When there is marked diminution in the quantity of urine, and anasarca is universal and extreme, and the phenol-sulphone-phthalein and other tests show a marked loss of functional activity, the patient will seldom survive more than a few months. When the urinary quantity is not much reduced below the normal, and the urine, though containing a large amount of albumin, shows only a limited number of tube casts and leucocytes, and the functional activity is not pronouncedly reduced, the condition may run a much more chronic course, and pass ultimately into the 'small white kidney'. The patient may have periods of fair health; but a small upset, such as a mild tonsillitis, may precipitate grave symptoms, with a recurrence of œdema; and during one of these exacerbations the patient dies. Help in prognosis may be obtained by considering the functional activity of the kidneys, the condition of the circulatory system, and the results of treatment. When there is marked delay in the excretion of iodide of potash, or of phenol-sulphone-phthalein, the prognosis is grave. Yet at times the excretion of the phthalein may be as low as 16 per cent in two hours, months before the fatal issue. Cardiac dilatation and arterial degeneration are of grave import. Œdema may be due to salt retention; but salt retention may be combined with degenerative changes in the smaller vessels, and with cardiac failure. When œdema is due to salt retention, there will be diminished chloride excretion in the urine, and a salt-free diet will usually give considerable amelioration of symptoms. When salt-free diet is instrumental in producing a diuresis with diminished œdema, prognosis is less grave than when vascular degeneration and cardiac failure are causal factors which are uninfluenced by a salt-free diet. In those cases the mere mechanical presence of the fluid in the cavities and tissues has a deleterious influence on the functional activity of the organs, and increases malnutrition. Neither the alimentary canal nor the heart can carry on its work efficiently; anæmia and malnutrition increase; and defective coronary circulation adds to the difficulties of the already embarrassed heart. Again, it may be found that, at times, a period of protein-free diet will give considerable relief of symptoms. Speaking generally, then, it may be concluded that response to treatment makes the immediate prognosis less serious, while want of proper response renders it very grave.

Chronic Interstitial Nephritis.—Pathologists are gradually returning to the view that the underlying and primary factor in chronic interstitial nephritis is a disease of the smaller blood-vessels, a widely diffused disease of the arterioles of the internal organs, in which the vessels of the kidney participate. The disease, in its fully-developed form, involves the kidney, producing the primary contracted or small red granular kidney. This being so, it may at once be granted that the condition is incurable. True it is that Senator has stated that recovery is possible if the disease is taken early; but this, if correct, is exceptional, and is outside the field of practical politics. Yet cases as seen in private practice must not be assessed at the same degree of gravity as the fully-developed picture obtaining in the hospital ward. The established diagnosis of chronic interstitial nephritis does not by any means condemn the sufferer to a life of invalidism. In the writer's experience, the existence of chronic interstitial nephritis has been compatible with an active business career for fifteen years after the diagnosis was definitely established. Other observers have recorded cases where the condition has lasted twenty, and even thirty years. Prognosis depends, not so much on anatomical changes, as upon the functional activity of the kidney and of the heart. This being granted, it is obvious that the patient has a right to a full knowledge of his condition and the factors which should regulate his life—for much of the outlook will depend upon his ability to lead a simple

life. It is fortunate when the disease is discovered early, and when the physician can obtain the hearty co-operation of the patient in regulating diet and working hours, with a view to maintaining reasonable health and prolonging life. As Janeway points out, cases of chronic interstitial nephritis fall into two groups. In one group the clinical picture is that of some degree of cardiac insufficiency, and death is a cardiac death. In the second the predominant symptoms are cerebral—headache, vertigo, and apoplectic attacks—and there is evidence of severe renal insufficiency. In forming an estimate of the gravity of the prognosis, consideration must be given to the condition of the circulation, to the kidney function, and to the occurrence of complications of a uræmic type. Every case will require individual study, and too much importance must not be given to a single factor.

Cardiac hypertrophy of the concentric type, with high blood-pressure, will be present; yet if the functional activity of the organ be maintained, immediate prognosis may be favourable. Unfavourable phenomena are those suggestive of loss of compensation—palpitation, dyspnoea on mild exertion, and marked increase in the area of cardiac dullness, with some oedema about the ankles. These factors show a loss of tonicity. No doubt they may disappear under therapeutic measures, but they show that the heart has been working beyond its reserve, and that a breakdown is imminent. In this respect, consideration of the *blood-pressure* is important. It may be accepted that, within reasonable limits, high blood-pressure is necessary in these cases to maintain the functional activity of the kidney; but excessive blood-pressure throws extra work on the heart, and it may break down under the strain. A blood-pressure of 180 to 200 mm. Hg, or over, must tax the powers of the heart considerably, and must lead in the end either to cardiac insufficiency or to a cerebral hæmorrhage. A systematic estimation of the blood-pressure will greatly help the practitioner in forming a prognosis. Given that it is moderately high, constant from month to month, with no signs of failing tonicity, and with fair general health, prognosis may be regarded as comparatively favourable. If, however, notwithstanding treatment, the pressure is persistently rising, prognosis becomes grave; either the heart will fail, or a cerebral hæmorrhage will close the scene. (*See ARTERIAL TENSION, HIGH.*)

A factor which must be taken into consideration in prognosis is the patient's ability and willingness to carry out treatment. The patient who can spend the winter months in an equable and mild climate, pay an annual visit to a spa, and carefully carry out directions as regards the avoidance of chills, over-work, and dietetic errors, has obviously a far better chance of prolonged life than the working man exposed to all weathers, or the harassed professional or business man living a life of strain.

The manner of death in chronic interstitial nephritis must always be uncertain; most commonly, however, it is a cardiac death, a death from failing compensation, at times combined with distressing uræmic symptoms. Cases of sudden death from cerebral hæmorrhage are not uncommon.

Albuminuric Retinitis.—The practitioner will find the systematic use of the ophthalmoscope a most valuable aid to prognosis in chronic nephritis. The retinal changes which may be present have been enumerated by Gowers as: diffused opacity from oedema, white patches, hæmorrhages, optic papillitis, diffused retinitis, and optic changes consecutive to inflammation. Of these changes, the first three are comparatively common, the second three are of less frequent occurrence. The most characteristic and striking are the white or yellowish glistening spots about the macula and optic disc and, in more advanced cases, scattered through the retina. At first small and scattered, they may coalesce and form larger spots which, situated in the proximity of the disc, may be as large as the disc itself. At the macula, they occur as numerous small glistening points; or they may radiate as interrupted lines, or fan-like streaks, in all directions. These changes are degenerative in character, and may be accompanied by hæmorrhagic extravasations; or extravasations may occur alone, and may vary, according to age, from the bright red of the recent, to the dark red and finally atrophic patch marking the site of absorption of a former, extravasation. The vessels of the retina will often show sclerosis, and as Gunn pointed out, they have an exceptionally bright reflex; the central light streak is very distinct and sharp, while the whole surface of the vessel is of a somewhat lighter shade than usual. These changes in the retina are degenerative in character, and

are collectively described as albuminuric retinitis. They occur most frequently in chronic interstitial nephritis, and are of very grave import. A patient with definite albuminuric retinitis seldom survives more than two years; a few cases are recorded where the patient has lived for longer, but these are the exception, not the rule. The gravity of albuminuric retinitis in its bearing on prognosis cannot be over-estimated. (Such a statement does not, of course, apply to the retinal changes which may occur in the kidney of pregnancy; there, complete recovery of kidney health may occur, but the patient may be left with permanently damaged vision.)

Estimation of Renal Function.—To the physician, anatomical changes are only important in so far as they interfere with the functional activity of an organ. By investigation of the activity of the kidney, valuable data will be obtained for the estimation of prognosis in nephritis. Of the different functional tests, the most valuable is the phenol-sulphone-phthalein test described by Rowntree and Geraghty; the simplest for the practitioner is the iodide of potash test.

The phenol-sulphone-phthalein test depends upon the capacity of the kidney for the excretion of the pigment. The apparatus required consists of a one-litre flask and a colorimeter. Before making the observation, the patient is given a drink of water. The injection, which can be obtained in an ampoule, 1 c.c. of which contains 6 mgrm. of the phthalein, is injected into the muscles of the lumbar region. The patient empties the bladder at the end of one hour after the injection, and again at the end of the second hour. The urine voided at the end of one hour is poured into a litre flask, and rendered strongly alkaline with caustic soda solution to give the maximum red colour; water is now added to the litre mark, and the mixture shaken and, if necessary, filtered to remove phosphates. The standard colour for comparison is obtained by the dilution of 1 c.c. of phthalein solution in a litre of water. This is placed in the standard tube of the instrument, while the urinary mixture is placed in the observation tube; the colours are adjusted, the scale is read off, and the percentage of excreted pigment obtained. Unless the excretion of phthalein is very much retarded, the ordinary urinary pigment does not interfere with accurate estimation. In health, 43 to 70 per cent (usually about 50 per cent) of the pigment is excreted during the first hour, 70 to 90 per cent during the first two hours; excretion is practically complete after two hours. A diseased kidney shows a very marked decrease in excretion during the first two hours. No pigment may appear by the end of the second hour in very grave cases of renal inadequacy. Excretion is noticeably decreased in acute nephritis, but it is especially in subacute and chronic conditions that the test is of value in estimating prognosis. Phthalein is excreted mainly, if not entirely, by the tubules, and deficient excretion points to a deficient functional activity of the tubules.

No absolute figures can be given as a guide to prognosis from the functional test; but, speaking generally, an excretion of 50 per cent and under shows serious renal inadequacy. In many cases of parenchymatous nephritis, excretion falls to 30 per cent or lower; the lower the percentage, the graver the prognosis. In chronic interstitial nephritis, when the kidney function is being fairly well maintained, excretion will be from 50 to 60 per cent. When uræmic phenomena are present, the percentage will fall very low, in some cases even to zero. In these cases there is pronounced inadequacy, with nitrogen retention. In chronic nephritis, a pronouncedly low excretion points to an unfavourable prognosis, even though no apparent uræmic phenomena are present.

The iodide of potash test is simple, but not of the same value as the phthalein test. If $7\frac{1}{2}$ gr. of iodide of potash be given to a healthy individual, it will be recognizable in the urine in a very few minutes; and the total quantity will be excreted within about sixty hours, when the urine will no longer give the tests for iodine. Iodide of potash is eliminated by the tubules, and when there is disease of the tubules the elimination of iodide is greatly delayed, the time being doubled or even trebled in some cases.

The Non-protein Nitrogen of the Blood.—The non-protein nitrogen of the blood is made up for the most part of urea, uric acid, and amino-nitrogenous bodies, and credit is due to the French school for strongly insisting on the importance of their estimation in considering the question of prognosis in nephritis. To Folin we owe a method of estimating non-protein nitrogen which is simple and accurate. The non-protein nitrogen of the blood stands in health at from 22 to 26 mgrm. per 100 c.c. of blood. It can be influenced

by diet, increasing after a full meal containing considerable protein, and diminishing on fasting. When kidney function is interfered with, there may be diminished excretion of nitrogenous waste products, and the blood-nitrogen will then rise. This phenomenon is not, however, present in every case of nephritis, and a normal or only slightly raised blood-nitrogen is a favourable factor in prognosis. When blood-nitrogen rises to 50 mgrm. or over in nephritis, the patient is suffering from serious nitrogen retention, there is grave renal inadequacy, and the prognosis is serious. At times the blood-nitrogen may rise to a high figure. Speaking generally, it may be stated that when the non-protein nitrogen of the blood rises above 100 mgrm., the duration of the illness may be reckoned in days, seldom in weeks.

Francis D. Boyd.

NERVE INJURIES.—These differ from those of other structures by reason of their function. Not only does the nerve itself suffer, but the parts supplied by it are affected, and it is with regard to these as well as, and more often than, to the nerve itself, that the treatment is directed and the prognosis depends.

Injury may affect a nerve in its course (in continuity) or at its termination, one of its branches of distribution being involved.

INJURY IN CONTINUITY.

Two groups are recognized :—

1. Those in which the naked-eye continuity of the nerve is interrupted *partially* or *completely*, which I am accustomed to term anatomical division.
2. Those in which the injury produces partial or complete interruption of conduction without naked-eye solution of continuity. To this I give the name physiological division. This classification, which was introduced by the writer in 1903,¹ is now generally accepted.

Prognosis in General.—Prognosis depends not only upon prompt treatment at the time of the accident, but to a large extent on efficient supervision for many months. The treatment of injury to a nerve in its continuity consists in keeping up the nutrition of the parts supplied by it and preventing the occurrence of contractures in muscles opposed to those affected, until conduction is restored by natural means alone or aided by operation. In comparatively few cases, apart from accidental wounds in which it is essential, is operation necessary; it should always be avoided if possible, and sufficient time given to be certain that recovery will not ensue unaided.

The large number of peripheral nerve injuries that came under observation during the course of the war have revealed no new facts with regard to prognosis. They have, however, amply confirmed our previous experience.

The imitation of movements normally carried out by the paralyzed muscles and performed by those supplied from another nerve was well recognized by Létievant nearly fifty years ago under the name of supplementary motility (*motilité suppléée*). As the result of experience gained by surgeons during the recent war, they have been brought again into prominence under the name 'trick' movements, the old error of regarding them as evidence of recovery being repeated.

Relaxation of paralyzed muscles must be maintained until voluntary power is restored; unless this is done, recovery may be indefinitely delayed. This muscular relaxation is the most important point in treatment, but it is the one most often neglected. It is quite useless to undertake the treatment of a case of nerve injury unless this can be carried out. While formerly it was a common experience to find patients with nerve injuries, particularly those of the musculospiral, under treatment with no attempt being made to relax the paralyzed muscles, it is fortunately now a rarity.

In cases needing operation it is too often assumed that when once the ends of the nerve have been united the surgeon's work has ceased; it has only just begun. The careful supervision of the patient and the direction of the treatment, it may be for two or three years, or even longer, is most important.

COMPLETE ANATOMICAL DIVISION.

In complete anatomical division, immediate primary suture is the correct procedure, the nerve being united by absorbable suture and wrapped to prevent the formation of adhesions.

Prognosis after Primary Suture.—Primary union, by which was understood union of the divided ends of a nerve without the occurrence of complete degeneration in its peripheral end, is not possible. This subject excited considerable controversy between the years 1860 and 1880. To Létiévant² is due the principal credit of explaining by his clinical observations the fallacies upon which the assumption was based.

Before recovery can take place, degeneration must occur in the peripheral end of the nerve, followed by regeneration and reunion with the central nervous system.

Many papers have been written concerning the time of recovery after primary suture, but in the majority of instances they consist of collections of isolated cases recorded by others. The fallacies are so numerous, the question of the exact details of the operation and after-treatment is so impossible to define in collections of this type, that the conclusions are of little value.

One of the earliest tables of collected cases occurs in Howell and Huber's³ masterly paper on the regeneration of nerves. They concluded that 66 to 80 per cent of the cases recovered.

Sir Anthony Bowlby⁴ appears to have been the first to attempt to settle the question by personal observation of a series of cases. He observed the results of 28 cases of primary suture, in many of which, however, the first note was made several years after suture. He considered 16 were successful and 4 failures.

Dr. Henry Head and the writer⁵ published a series of cases investigated at short periods from suture to recovery. The question was fully considered by the latter in his Erasmus Wilson Lectures in the following year.⁶

Perfect recovery is possible after primary suture; perfect function may be restored to the affected muscles, and no difference noticed by the patient in the sensation of the part as compared with the corresponding sound one. Although possible—and I have seen it follow primary suture even of the ulnar nerve—it is unusual. For it to occur, the operation of suture must have been carried out with great care, so that 'shunting' of nerve-fibres is reduced to a minimum, the wound must heal by first intention, and the after-treatment be efficient.

The prognosis will depend to a certain extent upon the nerve injured; for example, the musculospiral nerve in the lower third of the arm carries no exclusive supply to any portion of skin, and the muscles it innervates are not so intimately associated with delicate movements of the fingers as are those supplied by the ulnar. Complete recovery is reached more frequently and more rapidly than in other nerves.

The further the seat of injury from the periphery, the longer the time necessary to full recovery, and the less likely is it to occur.

If the nerve injured is the median or ulnar, it is improbable that recovery, either motor or sensory, will be sufficient to enable delicate movements to be skilfully performed. Thus, while the hand might be perfectly useful to an unskilled labourer, it would be a useless member to an artist or executive musician.

The time after suture at which recovery occurs varies with the distance of the point of suture from the periphery and the method of healing of the wound; suppuration prolongs it very considerably. In division of one of the nerves of the forearm, muscular recovery commences about nine months after suture, but perfect sensory recovery cannot be expected under three years.

Secondary Suture.—Recovery is much slower and prognosis less hopeful than after primary suture, except in the case of the musculospiral nerve; in none of my 67 personal cases of suture of other nerves, or in many in whom the operation was carried out by others, which have been seen at varying times after suture, did perfect recovery ensue. While this is possible after primary suture, it is improbable after secondary. Professor Stopford,⁷ in reviewing 271 cases, stated that there was no example of perfect recovery. Sir William Thorburn,⁸ in opening a discussion at the meeting of the British Medical Association, concluded that "a perfect neurological recovery is rarely, if ever, obtained". This was the experience of subsequent speakers.

Secondary suture of the musculospiral nerve, however, if the operation is correctly performed and the after-treatment carefully carried out, should be followed by perfect recovery. During the recent war this became a common operation. When sutured in the middle of the arm, recovery of the supinator longus and extensors of the wrist

commences about the sixth month, and all the muscles are acting voluntarily by the twelfth.

The first question to be considered is the relation of the interval between division and suture to recovery. Howell and Huber,⁹ and Kennedy,¹⁰ among others, considered that the prognosis was better, and the time of recovery shorter, the sooner after injury the nerve was sutured. I stated in my Erasmus Wilson Lectures that there was no *direct* relation between the length of time which has elapsed since the injury in cases in which operation was performed before the lapse of two to three years. This is in agreement with Bowlby's¹¹ experience, and Stopford states that delay up to twelve or eighteen months had no effect. Although I believe that the time after injury at which suture is performed has no direct relationship to the length of time necessary for recovery, it has an important indirect one, in that most of the factors hindering complete recovery develop as time advances.

Although instances of 'successful' operation have been recorded nine (Jessop¹²) and fourteen (Chaput¹³) years after division, muscular recovery is unlikely after about three years.

There are many factors to take into consideration in estimating the chances of recovery: if the nerve was divided in an open wound, its method of healing—nothing hinders recovery to so great an extent as suppuration; the condition of the muscles as regards wasting and the retention of irritability to the constant current; the presence of contractures in opposing muscles, and the condition of ligamentous structures surrounding joints. The condition of the hand of a patient, for example, who has suffered division of the ulnar nerve below its dorsal branch, in whom a marked claw-hand has developed, is little likely to be improved by suture, although the muscles may regain their irritability to the interrupted current.

The time after the injury at which the operation should be performed is of great importance at the present time. The majority of operations necessary as the result of war injuries of nerves have to be carried out through tissues which have been infected and in which suppuration has often been prolonged. *At least* six weeks should elapse between the *sound* healing of the wound and any operation on a nerve. Unless sufficient interval has elapsed, infection occurs, preventing complete success.

It is extremely important to attempt to estimate the probable extent of recovery. From the motor standpoint, if great wasting with contracture has occurred, as is so common after ulnar injuries, operation is not worth undertaking; if there is no contraction on stimulation with the constant current on several examinations, suture is useless. The length of time irritability persists varies, but I have obtained response twenty years after division. But if trophic ulceration is present, operation will cure it and prevent recurrence, for protopathic recovery is almost certain, and ulceration, as Head and the writer have shown, ceases on the restoration of protopathic sensibility.

Considerable interest attaches to the commencement of the first stage of restoration of sensibility. From time to time instances of 'rapid' return of sensibility after secondary suture have been recorded by many observers. I have examined for it after operation in all my personal cases, but have not yet observed it. All cases brought to my notice during the recent war were fallacious. When careful tests of sensation were made before and after suture, and duly charted, no change was noted when the same method of testing was employed. In one patient upon whom I had performed secondary suture of the median nerve, it was said that sensibility to prick had returned on the day following operation. On testing, I found that he complained of pain on pressure, but could not distinguish the sharpness of the point of a pin; it was equally painful, and produced the same sensation, as pressure with the blunt end of a pencil; moreover, he was entirely insensitive to the painful interrupted current, and all temperature appreciation was absent. There was no doubt that the pain was that caused by deep pressure, which could be readily evoked before operation.

The time of commencement of the first stage of sensory recovery may be shorter than after primary suture, the changes of the peripheral end necessary to regeneration of the nerve being advanced at the time of suture. I have seen it as early as the thirtieth day, but much variability obtains, and, speaking generally, the time necessary for the completion of the first stage is always long, and the interval between the second

and third nearly double as long. I have never yet seen perfect sensory recovery after secondary suture (except in the case of the musculospiral), although I have watched patients for over seven years, and examined them up to fifteen years after suture. In all, some difference could be appreciated between the two limbs, an area of changed sensibility remaining, with imperfect appreciation of the compass test. Much less variation occurs with regard to motor recovery, but the time required is invariably longer.

Prognosis after Nerve Bridging.—Under the term ‘nerve bridging’ are included all those procedures which are undertaken to restore anatomical continuity when the ends of a divided nerve cannot be brought into apposition. We have a choice of methods that have been used more or less successfully from time to time. Those of proved value may be put into four groups.

1. Transference of a portion of nerve from another source (nerve transplantation).
2. Provision of a path along which the nerve may regenerate (tubular suture, flap operations, etc.).
3. Utilization of neighbouring nerve (anastomosis or crossing).
4. Shortening the limb by resection of bone.

Nerve transplantation is the operation of choice. In 1906¹⁴ I investigated the recorded cases of nerve transplantation, added fresh cases, and brought others up to date. Among the 30 cases, 8 were examples of transplantation of human nerve (homo-transplantation); of these, only 3 were reported at a sufficient interval after operation to admit of recovery. This was complete in 2. Out of 22 instances of transplantation of nerve taken from one of the lower animals (hetero-transplantation), 16 were reported at a period after operation that would have admitted of some recovery; of these only 1, or at the most 2, recovered completely.

Tubular suture aims at providing a path for the new axis-cylinders, free from fibrous tissue. Many substances have been used for this purpose, among them decalcified bone, collodion, preserved animal's artery. I prefer a tube composed of a portion of one of the patient's superficial veins. In performing this operation the nerve is prepared and both ends are freshened; a portion of superficial vein of appropriate size is then excised and slipped over one end of the nerve. The ends are loosely united with catgut, the vein is drawn over the junction, and the whole surrounded with fat or Cargile membrane. The results given by this operation are superior to those obtained from hetero-transplantation.

There is considerable difference of opinion with regard to the value of these proceedings. The writer has not personally seen any successful case. The full record of cases operated upon by this method during the war is not available; but Professor Stopford¹⁵ and H. Platt¹⁶ have published 30 cases: 18 homo-transplantation, 1 hetero, 11 catgut bridging, 2 fascial sheath, and 1 in which vein was used. None showed any clinical evidence of sensory or motor recovery. The writer, however, has had 3 cases of tubular suture in which considerable recovery, both motor and sensory, occurred.

The results of flap operations have been uniformly unfavourable. Experience gained in the war has confirmed this.

The possibility of utilizing neighbouring nerves attracted the attention of investigators at an early date. Two distinct operations are included—nerve crossing and nerve anastomosis. In nerve anastomosis, an attempt is made to bring the axis-cylinders of the affected nerve into end-to-end contact with some of those of the sound nerve; in nerve crossing, the peripheral end of the affected nerve is united end-to-end with the central portion of a divided sound nerve.

Excluding the cases in which the operation was performed on the facial nerve, I collected 25 examples; of these, 12 were reported at a sufficient time after operation to enable an opinion to be given as to the result. Two were undoubtedly perfectly successful. Four were certainly improved by the operation, and were probably successes, but the records are too scanty to enable a definite opinion to be given. Thus, out of the 12 cases reported sufficiently long after the operation, only 2 were failures; some improvement took place in all the others. This is a better result than that given by Powers,¹⁷ who considered that 50 per cent were successful. Experience gained in the recent war is distinctly unfavourable to this method of treatment. In 7 cases recorded by Stopford,

in all of which the ulnar had been laterally united to the median, all were failures and in all conduction in the median had been interfered with, in two very seriously.

The prognosis in cases of bone-shortening is that of secondary suture.

INCOMPLETE ANATOMICAL DIVISION.

In order to understand the prognosis of these injuries, their nature must first be considered.

In wounds of nerves which do not completely interrupt continuity, it is found that at least a third of their diameter may be destroyed without producing any change, or one of a transient nature only, unless the injury is near the point at which a branch is given off, when the symptoms resemble those of division of that branch.

This is confirmed by the experiments of Bruandet and Humbert,¹⁸ who found that the fibres in a peripheral nerve which go to make up any branch do not become grouped until just before it leaves the parent trunk. In certain situations also—for example, in the anterior primary division of the fifth cervical nerve—the nerve fibres are arranged in a well-defined order, and incomplete division of this nerve may entail complete division of those motor fibres which supply the spinati and deltoid muscles. Again, in the trunk of the great sciatic nerve the external and internal popliteal nerves remain separate; hence incomplete division of the great sciatic may cause complete division of the external or internal popliteal nerve.

In accidental wounds of nerves, in addition to the incomplete anatomical division, there is usually physiological division, the result of the transient compression of the intact nerve fibres by the cutting instrument or effused blood.

Absence of symptoms in many cases is due to the fact that more nerve fibres are present in the trunk of a nerve than are necessary to the supply of the part. When symptoms are present, the recovery of function is due to restoration of conduction in the fibres which have suffered an incomplete physiological division. Those fibres which are separated from their nerve centres must of course degenerate and regenerate before they can again carry on their functions. It must, however, be remembered that the injury to the anatomically intact nerve fibres may be so great that complete physiological division is produced; this may also arise at a later period as the result of compression by fibrous tissue.

If efficient treatment at the time of the accident, or later, is carried out, recovery is usually perfect, both motor and sensory. In some cases, however, in which the treatment at the time of the injury was not operative, complications ensue. After a period of improvement, deterioration of function sets in, due to involvement in fibrous tissue. Recovery in these cases does not usually occur apart from operation.

In other instances pain arises in the full distribution of the injured nerves, sometimes accompanied by hyperalgesia, in rare instances by glossy skin. In these cases the damaged portion of the nerve should be removed and continuity re-established; the prognosis is then that of secondary suture. It was my experience during the recent war, however, that in many of these cases this ideal treatment is impossible on account of the extent of nerve involved. In such circumstances I have resorted to injection of the nerve above the seat of the injury with 90 per cent alcohol. This has proved completely successful in my hands, resulting in the immediate relief from the agonizing pain from which these patients suffer. Sensation begins to be restored, and nerve recovery ensues, at about the same time as after primary suture at the site of injection. Pain very rarely recurs.

Subcutaneous Injuries.—Taken generally, prognosis is much more favourable than after nerve section, except in the case of traction injuries of the brachial plexus.

As the result of pressure—long-continued or sudden—all the immediate symptoms of complete division may develop. When the injury is incomplete and physiological, recovery rapidly ensues. All forms of sensibility recover together, and the power of localization, so seldom restored after suture, is rapidly regained. With regard to motor symptoms, unless the reaction of degeneration develops, voluntary movement is quickly regained by the affected muscles. Restoration of sensibility to all forms of stimulation is usually perfect within six to twelve months.

At the end of a fortnight, if the affected muscles are still paralyzed, their electrical

reactions should be taken. If at this date the muscles react to the interrupted current, or give the reactions of incomplete division, non-operative treatment should be continued. Recovery can be confidently expected in the former case in a few weeks, in the latter in a few months. If true reaction of degeneration develop, the prognosis is unfavourable; operation becomes necessary, with all the drawbacks of secondary suture. After neurolysis has been carried out, recovery is usually rapid.

INJURY TO TERMINAL BRANCHES

The principal symptom of the involvement of the terminal branches of a nerve in scar tissue or callus is pain referred to the distribution of the roots from which the affected nerve arises, with in some cases paresis or paralysis. In civil life these symptoms are seen most often after finger amputations.

The prognosis is good if the condition causing the symptom is removed by operation, when the pain and tenderness are still confined to the scar or stump; when they have spread to other nerves, or are associated with hysteria or muscular affections, it is by no means favourable.

If the pain is not relieved, or recurs, no further local operation should be done if the first was thorough. Before proceeding to the only remaining operative treatment in these cases—division of posterior roots—Weir-Mitchell treatment must be tried after removal of all cause for worry. It is useless treating advanced cases while compensation proceedings are pending. Weir-Mitchell treatment must also be adopted after operation in the cases complicated by hysteria. When muscular symptoms are present, the affected muscles must be kept relaxed by suitable apparatus, and daily massage given until voluntary power returns. It is often twelve months before muscular recovery is complete.

At the present time we are all familiar with these symptoms after amputation of the limbs for war emergencies. In many of these cases no attempt can be made to cut the nerves short, so that the frequency of painful stumps is not to be wondered at. The appropriate treatment of the nerves at the time of amputation prevents this complication. Both free excision and the injection of the nerve well above the seat of the mischief give good immediate results. The prognosis of the former is, however, better, as in the latter the cause of the pain usually remains to re-establish it after the effects of nerve blocking have passed off.

SPECIAL NERVES.

Facial.—The nerve may be injured as the result of fracture of the base of the skull primarily or from involvement in callus, and during the course of mastoid operations, during operations in the parotid or submaxillary regions, or from forceps pressure during childbirth.

When injured as the result of fracture, whether involved primarily or secondarily, the division is usually incomplete, and perfect recovery ensues in about three months. Facial paralysis following operation on the middle ear is, as a rule, due to incomplete division. Spontaneous recovery is usual in the majority of cases, but may take twelve months. The incomplete facial paralysis, which may occur as the result of operations in the submaxillary region, is rarely permanent if the wound heals by first intention.

Careful electrical testing is necessary in order to enable an opinion to be given with regard to the necessity of operative treatment. If true reaction of degeneration develops, no time should be lost, but operation carried out.

In but few cases is it possible directly to unite the divided ends of the nerve; nerve anastomosis is necessary.

The best results are given when, as first suggested by Körte,¹⁹ the hypoglossal is used and the anastomosis is of the partial peripheral type. The prognosis varies with the cause of the paralysis, being better when the division results from injury than when it is the result of neuritis. Suppuration of the operation wound renders success doubtful.

The first sign of recovery usually appears about the third or fourth month, the face while at rest becoming more symmetrical, although there is no return of voluntary power. A few weeks later it is noticed that the angle of the mouth can be moved, at first only with movements of the tongue; then the muscles of the upper lip, and finally those of the forehead. With exercise, the movements become dissociated, and finally emotional movement may return.

For a few weeks after operation the side of the tongue is paralyzed, causing difficulty in speech and deglutition; this passes off, but the affected side may remain smaller for a considerable time.

In forty cases collected by the writer, improvement occurred in all reported at a sufficiently late date; but in comparatively few did emotional movement return, the face on the side of the injury remaining immobile in smiling. It is safe to say that in the majority of cases the appearance of the face at rest will become normal.

Recurrent Laryngeal Nerve.—This nerve is occasionally injured in operations upon the thyroid gland. The paralysis is usually temporary, and disappears within three months. If at the end of that time recovery has not taken place, operation offers a good chance for recovery. In the first case of secondary suture recorded (Shelton Horsley²⁰), recovery was almost perfect fifteen months later.

Brachial Plexus.—It is now well established that the prognosis of injuries to the brachial plexus, taken as a whole, is worse than those elsewhere.

Von Bruns²¹ found that while spontaneous recovery ensued in 66 per cent of subcutaneous injuries of peripheral nerves, only 26 per cent of similar plexus injuries got well spontaneously. Warrington and Jones,²² from the examination of cases under their care, found spontaneous recovery in 30 to 40 per cent. These unfavourable figures are due in part to the nature of the injury. In a large proportion of cases the nerves are overstretched, and this results in hæmorrhage into the sheath and consequent fibrosis; in addition, if it leads to rupture, the fibres give way at different levels; hence spontaneous recovery is unusual when the signs of complete division are present, and is apt to be imperfect in cases of incomplete division. Again, it is possible that the injury in some cases tears the roots away from the cord. Even after operation, the prognosis is not so good as, for example, after secondary suture of the median at the wrist or the musculospiral. This has to do to a great extent with the length of time necessary to complete recovery; in many cases the patient ceases to attend for efficient after-treatment, and when recovery of the nerve has finally become complete, the muscles are atrophic, and contractures of the opponent muscle render the regeneration of the nerve futile.

Brachial Birth Paralysis.—The prognosis is favourable if treatment is adopted from the time of birth. Perfect recovery has taken place in 70 per cent of the cases under my care; but in these lesions particular care is necessary in order to prevent overstretching of the paralyzed muscles and over-action of their opponents. Unless this is carefully attended to, although the nerve recovers completely, the child is left with a damaged limb. This point has recently been emphasized by Fairbank,²³ who has devised an efficient splint for the purpose.

With regard to operation: this is necessary only in a minority of the cases. If at the end of three months from birth the reaction of degeneration is present, operation should be carried out as soon as convenient. If it is possible to excise the damaged portion of nerve and perform end-to-end suture, the outlook is favourable; but when this is impossible and nerve anastomosis becomes necessary, perfect recovery is unlikely to take place.

Post-anæsthetic Brachial Paralysis.—These injuries of the plexus are by no means uncommon, although published cases are few. Cotton and Allen,²⁴ in 1903, were only able to collect thirty from the literature. It occurs in patients in whom, in the course of operation, the arms are abducted and externally rotated or raised above the head. The right arm is usually affected. Stretching over the head of the humerus with the arms elevated above the head is the probable cause of the infraclavicular injuries. In all cases the lesion is incomplete, corresponding to the slight violence which produced it.

The prognosis is good; all the cases that I have had under observation have recovered completely without surgical intervention, and all except one of those collected by Cotton and Allen.

Injury due to Presence of a Cervical Rib.—A cervical rib is by no means an unusual cause of injury to the brachial plexus as the result of long-standing pressure. In cases in which the nervous symptoms are marked, removal of the rib is the only treatment. The result of this is on the whole good. As in other cases in which muscles are affected as the result of prolonged nerve-pressure, the question of perfect recovery will depend upon

the extent of the wasting and deformity produced. When this is well marked, some atrophy and deformity of fingers always remain.

The nervous symptoms fall into two groups, paralytic and neuralgic. As a rule these co-exist. The subject has been fully discussed at the Royal Society of Medicine.²⁵ Thorburn reported 20 cases (14 personal), and came to the conclusion that pain was relieved in four-fifths; paralysis cured in certainly one-half. Sargent, as the result of operation on 29 cases, speaks of "the most gratifying immediate results obtained in those cases in which pain had been the prominent feature". Hinds Howell collected the after-results in 25 cases, and came to the conclusion that "in the majority of cases pain will be relieved or cured. With regard to muscular weakness and atrophy, the expectation is that the operation, if it is not too long delayed, will greatly improve the condition". (See CERVICAL RIB.)

It was pointed out that a paralysis of the brachial plexus may occasionally occur as the result of operation; but if performed by those skilled in the procedure it is unusual and transient.

Operative treatment undoubtedly removes the most distressing symptom of this condition.

Circumflex Nerve.—Injury to this nerve is rare, and is usually subcutaneous, the result of pressure of the dislocated head of the humerus or a crutch, and results in an incomplete physiological division. Treated on the usual lines, recovery ensues as a rule, but is generally slow. Even if the paralysis persists, operation is not often necessary, for the supinators and clavicular fibres of the pectoralis major acting with the trapezius may compensate for its loss.

Ulnar Nerve.—The prognosis in cases of injury to the ulnar nerve depends upon the care taken to prevent the development of claw-hand. If in cases of incomplete division or after primary suture a suitable splint is worn, perfect recovery may take place, although it is unusual in the latter.

Perfect recovery never ensues after secondary suture, or releasing the nerve from pressure in case of injury the result of old deformity of the elbow or long-standing dislocation. Some weakness of the intrinsic muscles of the hand always remains.

Musculospiral Nerve.—The prognosis is more favourable than after injury of any other nerve. It supplies no important area with sensibility, and none of the intrinsic muscles of the hand. Most of its injuries are subcutaneous, resulting in incomplete physiological division. If treated by relaxation of the paralyzed muscles, recovery is rapid, and usually perfect within three months. When operative treatment is necessary to free the nerve from injurious pressure, restoration of function usually commences in a few weeks. After secondary suture, motor power usually returns in nine to twelve months, and perfect use is regained within eighteen.

REFERENCES.—¹*Clinical Jour.* 1903, Nov. 13; ²*Traité des Sections Nerveuses*, Paris, 1873; ³*Jour. of Physiol.* xiv.; ⁴*Injuries and Diseases of Nerves*, London, 1889; ⁵*Brain*, Summer No. 1905, cx; ⁶*Lancet*, 1906, Mar. 17, 24, 31; ⁷*Trans. Roy. Soc. Med. (Neurol. Sect.)*, 1920, Mar. 11; ⁸*Brit. Med. Jour.* 1920, Sept. 25; ⁹*Loc. cit.*; ¹⁰*Brit. Med. Jour.* 1904, ii, 1065; ¹¹*Lancet*, 1902, ii, 198; ¹²*Brit. Med. Jour.* 1871, ii, 640; ¹³*Bull. et mém. Soc. de Chir.* 1905, xvii, 471; ¹⁴*Edin. Med. Jour.* 1906, Oct.; ¹⁵*Lancet*, 1920, Dec. 25; ¹⁶*Brit. Jour. Surg.* 1920, vii, 27; ¹⁷*Ann. of Surg.* 1904, xl, 632; ¹⁸*Arch. gén. de Méd.* 1905, No. 11; ¹⁹*Deut. med. Woch.* 1903, No. 17; ²⁰*Ann. of Surg.* 1910, i, 524; ²¹*Neurol. Centralb.* 1902, s. 1042; ²²*Lancet*, 1906, ii, 1644; ²³*Ibid.* 1913, i, 1219; ²⁴*Boston Med. and Surg. Jour.* 1903, cxlviii, 499; ²⁵*Proc. Roy. Soc. Med. (Clin. Sect.)*, 1913, vi, No. 5, 113-127.

James Sherren.

NEURALGIA, TRIGEMINAL.—We shall only consider here the prognosis of the severest form of neuralgia, tic douloureux, and shall assume that ordinary medical treatment, and the examination of the teeth, nasal accessory sinuses, etc., has proved abortive. The neuralgia is severe in character, comes on in occasional paroxysms, and shows no tendency to spontaneous cure.

The methods of treatment, then, with which we have to do, are (1) *The peripheral neurectomies*; (2) *Alcohol injection*; and (3) *The removal of the Gasserian ganglion* by the Hartley-Krause method.

1. **The Peripheral Neurectomies** such as removal of a piece of the lingual and inferior dental nerves, excision of the intra-orbital nerve, or the Braun-Lossén operation on the second division of the trigeminal nerve, are all comparatively safe, so far as the

immediate risk to life is concerned; they have the very serious drawback that permanent cure by their means is most exceptional; and when it does occur, it is always open to suspicion that some peripheral dental or other cause, capable of simple treatment, has been overlooked. Out of 43 cases treated by neurectomy, the average duration of relief from pain was ten months (Putnam and Waterman).

Nowadays, alcohol injection of the nerve-trunks should be preferred to neurectomy (Cushing).

2. Alcohol Injection into the Gasserian ganglion is somewhat difficult of technique, and it may not be possible to reach the desired spot; but it appears to be perfectly safe, so far as risk to life is concerned. Even if the injection is made by mistake into the subdural space, nothing worse than a headache results. The relief given, if the alcohol can be correctly placed, is very marked, and lasts for a long time, even if it is not permanent; there is usually complete freedom from pain for many months or years. Harris was able to give this relief in 80 out of 86 cases. The test of success is the production of immediate anæsthesia in the whole distribution of the fifth nerve. The injection can be repeated, if recurrence takes place, with equally good results.

Härtel followed up 25 cases, 15 for more than six months; of these 15, 9 were free from pain and 6 relapsed. A serious trouble is that keratitis may result; this took place in 6 out of the 25 patients, and one eye had to be enucleated. Possibly covering the eye may give better success. Cushing reports a number of other calamities, such as fibrosis of the pterygoid muscles, labyrinthitis, and oculomotor paralysis, from misplaced injections.

I have had several very successful cases, but in one of them there was some temporary facial palsy, and another lost the eye from trophic changes.

Removal of the Gasserian Ganglion is, no doubt, a serious operation, but the mortality, in skilful hands, is not as high as is commonly supposed. Horsley, Hutchinson, and Krause together report a death-rate of 4 per cent. Some years ago, Horsley had operated on 120 patients with 6 deaths. Hutchinson operated on 60 consecutive cases without a death, and subsequently lost one (a feeble old man). Rawling puts the mortality at 5 per cent. Very possibly it may be higher in the practice of those who have seldom or never performed the operation.

The relief appears to be complete and permanent, and recurrences are very unusual, although Hutchinson admits seeing "a few exceptions, difficult to explain". Three patients developed it on the opposite side. Hutchinson spares the ophthalmic division, which goes far to avert trophic changes in the eye.

Härtel shows that keratitis has followed in 30 out of 207 successful removals of the whole ganglion, that is, about 15 per cent.

Recently it has been advised to divide the sensory root behind the ganglion; this is easier than removing it, and is said to avoid all danger of keratitis. Cushing reports 312 consecutive cases without a death, but cases have been reported at the Mayo clinic.

REFERENCES.—Harris, *Lancet*, 1912, i, 218; Härtel, *Deut. Zeits. f. Chir.* 1914, xxvi, 429; Hutchinson, *Lancet*, 1918, ii, 12; Cushing, *Amer. Jour. Med. Sci.* 1920, Aug., 157; Cushing, *Jour. Amer. Med. Assoc.* 1920, Aug., 441.

A. Rendle Short.

NEURITIS.—There are two great groups into which cases of neuritis are classified: (1) *Multiple or peripheral neuritis*, where many or all of the peripheral nerves are involved; (2) *Local neuritis*, where only a single nerve, or portion of a nerve, is affected.

1. Multiple Neuritis or Polyneuritis.—In most cases this is due to some poison. This poison may be introduced from without, as in the cases of alcohol, arsenic, lead, or (less commonly) mercury, phosphorus, or copper; or it may be the result of micro-organisms producing specific diseases, or of their toxins, as in diphtheria, influenza, malaria, septicæmia, gonorrhœa, beri-beri, leprosy, syphilis. Multiple neuritis may also be produced by poisons arising within the body, as in diabetes, pregnancy, etc.

Of these varieties, the commonest of all is alcoholic polyneuritis. It is unnecessary to describe the clinical features of this disease. Its onset is insidious, and the symptoms may take weeks or months to attain their maximum intensity. If the alcoholic habit continues, the neuritis persists indefinitely, until the patient becomes bedridden; contractures of the limbs develop, especially in the feet; and the patient dies, sooner or

later, from some intercurrent malady, usually of pulmonary origin. If however, the poison be withdrawn, and if massage and electrical treatment are then assiduously carried out, the symptoms may even continue to increase for two or three weeks, before coming to a standstill. There is then usually a stationary period of one or two months before signs of improvement begin to appear. Then the pains and the hyperæsthesia gradually diminish, the cutaneous anæsthesia clears up, and the motor paralysis recovers in from four to six months from the time of onset of improvement; the proximal muscles recover before the distal. Last of all, the deep reflexes return; a patient may have complete sensory and motor recovery for weeks or months before the deep reflexes reappear.

The *prognosis as to life*, in a case of multiple neuritis from any cause, depends on various factors. The motor, rather than the sensory, symptoms are of significance in this respect. The more rapid the onset of paralytic symptoms, the more dangerous is the case. When the symptoms have attained a considerable severity within a few days, there is a grave risk of extension to the respiratory muscles. Implication of the diaphragm and intercostals greatly increases the seriousness of the case, more especially if the cardiac muscle be enfeebled, as is so often the case. Patients with multiple neuritis have a particularly feeble power of resistance to pulmonary infections, whether by the tubercle bacillus, the pneumococcus, or other organisms; and the presence of lung complications, even a simple bronchitis, is always a serious matter in such patients.

A characteristic form of mental affection, known as *Korsakow's psychosis*, occurs in some cases of polyneuritis. Its symptoms are those of mild mental confusion, especially with regard to times and places, together with impairment of memory for recent events; so that a patient who is bedridden from polyneuritis may give descriptions of recent imaginary long walks which she has taken (the patient is usually a woman), and of the various people and places whom she has thus visited.

The nature of the poison which produces the multiple neuritis has little or no influence *per se* upon the prognosis as to recovery. The different forms of polyneuritis run a similar course. A great deal, however, depends on whether the source of the underlying poison, once it is recognized, has already been removed, as in diphtheria or septicæmia; whether it can be cut off with ease, as in lead or arsenic; whether there is a tendency to relapse, as in alcohol; or finally, whether it cannot be removed, as in diabetes, cancer, leprosy, etc.

2. Local Neuritis.—Recognition of the underlying cause, and its removal, if possible, are the first essentials in every case of local neuritis. Thus, in a neuritis due to local pressure (e.g., by crutches, callus from an old fracture, cicatricial tissue, cervical ribs, tumours, etc.) the underlying cause can sometimes be removed. In other cases, the exciting cause has already produced its effect on the nerve-trunk, and we have to deal with the result (e.g., in local neuritis due to bruising or inflammation of the nerve, or to exposure to cold). In other cases still, we have to do with a disease which produces a primary degeneration of the nerve-fibres (e.g., in diabetes, malaria, enteric fever). In a still further class, the fibrous tissues of the nerve-trunk, its sheath or perineurium, are primarily attacked, and the degenerative changes are secondary (e.g., in gouty, syphilitic, and leprosy neuritis). The prognosis, then, of any individual case of localized neuritis is that of its underlying cause.

Electrical Reactions.—In cases of local neuritis of a mixed nerve, where sensory and motor phenomena are present, sensory functions generally recover before motor, although this rule is not without its exceptions.

With regard to motor paralysis, the prospects of recovery are best estimated by a careful study of the electrical reactions. To make an accurate prognosis, however, the motor paralysis must have lasted at least ten days, to allow time for degenerative changes, if any, to have developed. If, after ten days or a fortnight of motor paralysis, we find the typical 'reactions of degeneration'—i.e., total loss of faradic excitability, with reversed polar reactions and a slow, sluggish response to galvanism, the degeneration of the nerve fibres is complete, and recovery will not commence for three months at least, possibly not for a year; and even then, if recovery ultimately sets in, it will probably be imperfect and associated with a certain amount of contracture. If, on the other hand, the electrical reactions are normal to faradism and galvanism, or if there be merely a quantitative diminution, without polar changes, recovery may be expected to begin in from three to

six weeks from the onset of the paralysis. Sometimes we meet with partial or incomplete reactions of degeneration, consisting in a sluggish contraction to galvanism, with reversed polar reactions, but with preservation of a certain amount of faradic response. In such cases, we may expect improvement in from six to eight weeks from the onset of the paralysis. In a regenerating muscle the slow response to galvanism, at closure and opening of the current, gradually becomes replaced by the brisk twitch of health, and this change precedes the return of voluntary power and of faradic response by a period varying from a couple of weeks to several months.

Examination of the reaction of the muscles to *condenser discharges* is a valuable addition to faradic and galvanic stimulation as a means of electro-diagnosis and prognosis. A healthy striated muscle-fibre reacts to condenser shocks of the smallest condensers (e.g., 0.01 to 0.12 microfarad), with the shortest and fastest wave lengths; whereas a degenerated muscle requires larger condensers (e.g., 0.50, 1.00, 2.00, or even 3.00 microfarads), with longer and slower wave lengths.

Voluntary power reappears in a regenerating muscle before any improvement occurs in the faradic or condenser reactions, except in some cases complicated by a functional element, in which the patient has failed to realize the existence of his voluntary motor power.

J. Purves Stewart.

ŒSOPHAGUS, STRICTURE OF.—Stricture of the œsophagus may be: (1) *Functional* (*cardiospasm*); (2) *Simple*, usually due to scar-contraction after swallowing a corrosive; (3) *Malignant*.

1. **Cardiospasm**, a condition in which the entrance into the stomach is tightly contracted, whilst the œsophagus above may be hugely distended, is rare. It may be recognized by the œsophagoscope, and by a skiagram after a bismuth meal. It persists for years, apart from treatment, and shows no tendency to spontaneous cure. Dilatation, by various complicated means, usually gives a good result. Adrenalin injections are said to abolish the spasm.

2. **Simple Stricture**, due to scarring, may be recognized by the history, by skiagram, by the failure to admit a bougie, and by the glistening white appearance without ulceration seen with the œsophagoscope. At least 9 out of 10 of the cases can be dilated up by bougies, passed, if necessary, by the aid of the œsophagoscope. If this fails, a temporary gastrostomy will often allow of successful retrograde catheterism; or, in a week or two, the rest to the œsophagus allows of a bougie being passed. Dilatation of the stricture has to be kept up for many years at regular intervals. Oser reports on the cases treated at Vienna during ten years. Out of 47 patients, 27 were treated by dilatation, with 21 cures and 1 death; 14 by gastrostomy and retrograde catheterism, with 10 cures and 1 death; 6 by gastrojejunostomy, etc. (for burns of stomach), with 5 cures and no deaths; the other patients were improved, or lost sight of.

3. **Malignant Stricture**, of course, has a hopeless outlook. Apart from gastrostomy, the duration of life is usually not more than six months from the onset of dysphagia; that operation prolongs life a few months. A good many deaths, and one success, have followed excision of the growth. Sometimes a radium tube can be introduced into the stricture by means of an œsophagoscope, and thereby the power of swallowing be restored; but in spite of this I have seen the difficulty return in a few weeks.

REFERENCE.—*Surg. Gynecol. and Obst.* (Abstract), 1913, xvi, 17.

A. Rendle Short.

OORYA FEVER OF PERU.—Strong reports the mortality of this disease to be usually 30 to 40 per cent. Pernicious anæmia is the most serious symptom, and may be fatal in three or four weeks.

Leonard Rogers.

OPHTHALMIA NEONATORUM.—(See GONORRHOEA, p. 235.)

ORCHITIS, TUBERCULOUS.—(See EPIDIDYMITIS, TUBERCULOUS.)

OSTEITIS DEFORMANS (PAGET'S DISEASE).—Of this rare disease not many more than a hundred cases are recorded, but most surgeons of experience can recollect one or two others which have not found their way into print. It is a chronic incurable affection which may not shorten life.

The strange feature of the prognosis is the considerable probability that a malignant bony growth will eventually appear. Of 34 cases followed to their termination, this was the cause of death in 12.

REFERENCE.—Elmslie, *St. Bart.'s Hosp. Rep.* 1908, 121.

A. Rendle Short.

OSTEO-ARTHRITIS.—(See ARTHRITIS DEFORMANS.)

OSTEOMALACIA.—This disease appears to be more commonly met with on the Continent and in some parts of India than in England or America. It affects young women for the most part, though a few cases are recorded in males and in children. The outlook is very grave. According to the older authorities, it goes on in most cases to a fatal termination in from two to ten years, the patient being bedridden most of the time. Durham records 22 out of 145 cases in which natural recovery, more or less complete, was observed. It is most unfavourably influenced by pregnancy, and is often first recognized at that time. As is well known, the pelvis becomes very contracted, and Cæsarean section will probably be required. The child is normal. Many of the mothers have died in childbirth.

In a small number of cases, double oophorectomy has been performed, and there is some evidence that this improves the outlook. Fehling reports 14 cases: 6 of these were cured for three years or more; 2 were better for a time and then relapsed; the rest died or were lost sight of. Other observers have recorded temporary benefit with relapse following.

There are a few cases known in which great benefit followed adrenalin injections.

REFERENCES.—Durham, *Guy's Hosp. Rep.* x., 1064; Knipe, *Amer. Jour. of Obstet.* 1912, lxxv, 582.

A. Rendle Short.

OSTEOMYELITIS.—It is not easy to estimate the prognosis of such a disease as this in formal terms, for any bone may be affected, and with every degree of severity.

Prognosis as to Life.—In many cases there is very considerable danger to life. The rare infections of skull and vertebral column are very fatal, and the majority of young children with perforation into the joint (Sir T. Smith's *acute arthritis of infants*) also die.

Even with the commoner affections of the long bones there is grave risk. During the years 1901 to 1910, at the London Hospital, 34 per cent of the patients died; the usual causes of death were endo- or pericarditis, empyema, or abscess of the lung. Others die of cachexia at a later date. At the New York Hospital, 1914 to 1918, out of 93 operated on, 9 died, although some of the patients treated had passed the dangerous acute stage.

Signs of danger are—extension of the infection over the whole length of a large bone such as the femur or tibia, involvement of the hip-, knee-, or ankle-joint, multiple bone involvement, rigors, and signs of trouble in the chest. In chronic cases, great wasting and cachexia, apart from efficient treatment, point to a probably fatal termination.

The younger the patient the graver the outlook. Early and thorough surgical intervention is of the utmost importance in the acuter types of the disease.

Prognosis as to Limb.—Very early operation, laying open the whole infected area, will avert the long illness which necrosis necessarily involves. Unfortunately the surgeon is generally too late, and part of the bone will die. In the worst cases, the periosteum is rapidly stripped up and the osteoblasts are killed, so that no regeneration of bone will take place. This is the rule in necrosis of the lower jaw. Usually, however, an efficient new bone is formed in time; but it takes months for the sequestrum to separate, and again, after that is removed, for the sinuses to close. It is likely to be from six months to a year or more before the patient is well.

Necrosis of the popliteal plate of the femur is a very trying condition for all concerned, as the separation of the sequestrum may take an interminable time. Many of the cases are cut short, at last, by an amputation, on account of failure of the general health. If the knee-joint is involved it is usually necessary to amputate; but I have seen one such case, infected from the femur, in a fair way to recovery.

Sometimes an attempt is made to avoid amputation by exsecting the tibia, leaving only the epiphyses. New bone is regenerated, but in my experience the limb is useless, and in one of my cases a pyæmic infection of the other hip took place.

REFERENCE.—Kennedy, *Brit. Med. Jour.* 1912, ii, 114.

A. Rendle Short.

OVARIAN TUMOURS.—The prognosis in ovarian tumours is very largely dependent upon the nature of the growth; with the exception of certain adventitious accidental events which we shall consider later, the outlook is good, doubtful, or bad according to the histological characters. At the outset, it cannot be too definitely asserted that naked-eye characters alone are an insufficient guide; and in no region of pathology are the services of an expert histologist, experienced in the study of ovarian tumours, more valuable than in expressing an opinion upon such a growth; even under the microscope, there are certain cystic-solid tumours on which it is difficult to express a decided opinion.

The relative proportion of benign to malignant tumours varies considerably; thus Macnaughton-Jones¹ collected the figures from German clinics, and in a series of 2893 cases only 11 per cent were reported as malignant; while Glendining² found 17 per cent carcinomatous out of 106 cases occurring in the Chelsea Hospital for Women in the years 1908 and 1909. At the Pathological Institute of the London Hospital in 1920 and 1921, Professor Hubert Turnbull reported 10 per cent of the 205 primary ovarian tumours passing through his hands as malignant. These variations in the percentage of malignancy are largely due to the standard set by different observers; border-line or 'semi-malignant' tumours are the great difficulty.

From the point of view of prognosis, we have always been in the habit of dividing ovarian tumours into three groups: (1) *The simple* (forming the largest section); (2) *The semi-malignant*; and (3) *The malignant*.

1. **The Simple.**—In the simple unilocular ovarian cysts, the results of the operation are good: probably there is no more uniformly successful operation in surgery. A small proportion of cases have to be opened up again owing to slipping of the ligature round the pedicle, and occasionally such a case is lost. This accident is due to bad surgical technique, and usually results from ligaturing a large pedicle together with a piece of the broad ligament, so that when the uterus is pulled on or displaced, a portion of the ligated tissues tends to be withdrawn. A more remote accident occasionally follows failure to bury the stump of the pedicle; in such a case the sequence of events is the formation of a band, the passing of gut under the band as in hernia, and eventual strangulation. A demonstration of the good immediate results of operation is given by Professor Donald's³ figures; he performed 252 operations for the removal of ovarian tumours of all varieties (including malignant ones) in institutions between the years 1912 and 1916 inclusive, and lost only 5 patients, a mortality of 2 per cent. It is interesting to analyze the causes of death in the five fatal cases. In two cases the tumour was malignant, and in one of these there were secondary growths in peritoneum and mesentery; in the third case a large pyosalpinx was removed from the opposite side; in the fourth the patient had a huge tumour and was *in extremis*, and the operation was undertaken as a last resort; in the fifth the patient had an adherent and inflamed appendix, which was extirpated after a large ovarian tumour had been removed.

2. **The Semi-malignant.**—This variety comprises those ovarian tumours known as proligerous cystadenomata and papilliferous ovarian cysts. In these cases, the chief difficulty arises in excluding malignancy, as many of them simulate columnar-cell carcinoma very closely under the microscope. They are here distinguished from the properly malignant cysts because they do not show true metastases. Secondary masses are the result of contact implantation; they are practically never found outside the abdominal cavity unless they occur in the scar of an abdominal incision, and they do not invade the lymphatic glands.

The presence of secondary nodules on the peritoneum, omentum, or intestine is not to be taken as indicating hopeless malignancy. Thomlin⁴ has recorded cases in one of which there were vegetations all over the peritoneum, and yet at the end of four years the patient was apparently well and cured; while in another case, having to leave a tumour the size of a hazel nut in the pouch of Douglas, he was able to assert three and a half years later that this mass had not increased in size. Pozzi⁵ says that he has himself observed that vegetations present on the intestines at the first operation were absent at a second operation.

The presence of ascites, although obviously a grave complication, is not to be regarded as hopeless, as numerous observations have been made in which the ascites was not necessarily fatal. The gelatinous fluid often encountered in some cases in this group must

be taken as grave, but is indicative of the semi-malignant character. The ordinary rules as to recurrence in malignant growths scarcely apply to the cases belonging to this group. Thus, Pozzi⁵ operated on a young girl with enormous ascites, and removed double papillomatous ovarian cysts; after twenty years the growth took on malignant characters, and the patient did not survive the second operation more than eighteen months. Such an observation, although extreme, is typical of many cases, and leads to the conclusion that in some instances the growths later take on a more malignant nature.

The clinical characters of the more malignant tumours in this group are—rapid and sudden enlargement, rapid loss of weight with cachexia, extensive fixation to neighbouring viscera and structures, considerable œdema of the limbs and abdominal walls when the volume of the tumour and the amount of ascites is taken into consideration; and finally, the presence of pleurisy.

The operative results in these cases are not good. Thus, in Mrs. Scharlieb's⁶ series, the immediate mortality—within a month of operation—was about 15 per cent, and at least 50 per cent were known to have died within three years. There seems to be no doubt that many cases in this group, if caught early before dissemination has occurred, are comparatively successful: when ascites and secondary vegetations are observed, it is still advisable to remove both ovaries if possible, as although ultimately the condition is almost certainly fatal, yet in some cases life is prolonged for years.

Many cases will require tapping from time to time, in order to relieve the intra-abdominal tension. This simple operation has been performed a considerable number of times—over a period of years in some cases—and not a few cases have been recorded where the patient has ultimately made a complete recovery.

3. The Malignant.—The third group includes malignant tumours, whether cystic or solid. In these cases the outlook is not promising. If at the time of operation there is no evidence of secondary spread—as shown by vegetations on the peritoneum, and the presence of free fluid—the prognosis is generally regarded as better; but it is surprising how often such cases return with metastases within the year; the original diagnosis was that of an endothelioma or cystadenoma, but in the light of subsequent history it has often to be changed to one of adenocarcinoma.

Kachel⁷ reports that of all malignant ovarian tumours upon which operation is performed, only 20 per cent are alive after two years, and that a considerable proportion of these cases have extensive recurrences of growth.

Secondary Changes.—*Axial rotation* occurs in about 2 per cent of cases of ovarian cysts, but generally is much more common in dermoid tumours and in cysts of medium size. The operative results are uniformly good, provided infection and necrosis have not occurred.

Infection most commonly occurs following an axial rotation. Provided the case is seen before extensive peritonitis has occurred, the results are good, if drainage is employed for a few days in all cases showing any rise of temperature.

Later results following mild infection of the ovarian tumour are seen in dense peritoneal adhesions, rendering operation tedious and difficult, and greatly increasing the risk.

Rupture was found by Spencer Wells, in a series of 1000 cases, to take place in 2.4 per cent, but this figure appears abnormally high. In the majority of cases rupture is caused by rough examination, occurs in broad-ligament cysts, and is attended by no ill effects. In a few cases, however, papillary cysts and dermoids rupture, causing dissemination of vegetations or dermoid structures. If the contents of the cyst be purulent, septic peritonitis develops. Cysts complicating pregnancy sometimes rupture during labour; the sudden rupture of a large cyst is usually attended by great shock and pain, vomiting, and abdominal distention, and an operation is urgently required.

Ovarian Tumours and Irradiation.—Ovarian tumours have been treated by x rays on the assumption that fibroids were under treatment, with the result that shrinkage has been described in one or two instances; but no record of complete disappearance exists. Kelly and Burnam⁸ record a case of an ovarian cyst which, one year after 60 mgrm. of radium had been applied for forty-seven hours, showed a reduction in volume from 8 to $1\frac{1}{2}$ inches in diameter. It must be said that radium and x rays have no place in the treatment of ovarian tumours.

Ovarian Tumours and Pregnancy.—The questions of operative interference and the result to be expected therefrom have special importance when pregnancy is complicated by the presence of an ovarian swelling. The inclination both of the medical attendant and of the patient is to postpone any operative interference; but the following figures, taken from a statistical article by Barrett,⁹ point unmistakably to the conclusion that the operative line of treatment is much the better course. He gives the results in 114 cases. Of these, 76 were operated upon before term: the maternal mortality is given as 1·3 per cent, and abortion or premature delivery occurred in 12 per cent; in 8 cases double ovariectomy was performed, and in 6 of these cases pregnancy continued to term. The other 38 cases were treated expectantly, and were not operated upon before term: the maternal mortality was 18·4 per cent; of the total 38 cases, 7 escaped operation, but 4 of these died, and the remaining 3 still have their cysts. The results in a much larger series of 720 cases is given by McKerron¹⁰; in more than half these cases the tumour was left alone, and resulted in a maternal mortality of 21 and a foetal mortality of 30 per cent; amongst the 299 cases treated by ovariectomy the maternal mortality was 3·3 per cent, and amongst the uncomplicated cases the operation was followed by premature expulsion of the ovum in 11 per cent only.

Ovarian cysts are peculiarly liable to pathological changes when associated with pregnancy; torsion of the pedicle is estimated to occur in about 12 per cent during pregnancy and in about 22 per cent in association with labour and the puerperium; suppuration is more common during pregnancy, but does not occur in more than 2 per cent of cases; rupture is estimated to occur in about 4 per cent of cases during pregnancy and labour.

Prognosis of Ovarian Cysts apart from Operation.—As all ovarian tumours nowadays are operated on, the question of exact prognosis in the absence of operative treatment is more difficult. It is necessary to refer to older writers, such as Spencer Wells,¹¹ who had occasion to see numerous patients who refused operation. He asserted that when the cyst had attained such a volume that the general health was affected, the duration of life would not exceed two years, and that these two years were full of misery, pain, and despondency.

On the other hand, T. P. Franck records a case of cyst known to exist at the age of 13, and still present at 88 years of age. Also cysts have been known to exist for twenty-five and even fifty years, but they were generally of dermoid nature.

REFERENCES.—¹*Proc. Roy. Soc. Med. (Obst. and Gyn. Sect.)*, 1910, i, 97; ²*Ibid.* 96; ³*New System of Gynaecology*, 1917, ii, 403; ⁴*Med. Times*, 1881, i, 213 and 275; ⁵*Traité de Gyn.* ii, 933; ⁶*Proc. Roy. Soc. Med. (Obst. and Gyn. Sect.)*, 1910, i, 85; ⁷*Centralb. f. Gynäkol.* 1907, li, 1603; ⁸*Jour. Amer. Med. Assoc.* 1914, ii, 622; ⁹*Surg. Gynecol. and Obst.* 1913, Jan.; ¹⁰*Pregnancy, Labour, and Childbed, with Ovarian Tumours*, 1903; ¹¹*Ovarian and Uterine Tumours*, 1882.

Bryden Glendining.

(Revised by Eardley Holland.)

PAGET'S DISEASE.—(See OSTEITIS DEFORMANS.)

PAGET'S DISEASE OF THE NIPPLE.—(See BREAST, SIMPLE DISEASES OF.)

PANCREAS, RUPTURE OF.—(See ABDOMINAL INJURIES.)

PANCREATIC CYSTS.—Cysts of the pancreas, excluding hydatids and blood cysts, are usually due to pressure upon the pancreatic duct, either by chronic inflammation of the head of the gland, or scarring after an injury. This being so, they almost invariably show a steady increase in size which necessitates interference, though they may not at the time be causing any great inconvenience. The usual procedure is to open the cyst, perhaps apply carbolic acid to its interior, plug it with gauze, and drain. To attempt to dissect it out is ordinarily too dangerous to be worth the trouble.

The simple operation for drainage is not very serious. Of 160 cases in the literature collected by Mayo Robson, 20 died and 140 recovered, though 1 died later of diabetes. Of 138 cases treated by incision and drainage, 16 died; of 22 treated by partial or complete excision, 4 died. Mayo Robson himself had 11 patients, of whom 10 recovered. There is, however, a good deal of trouble occasionally from persistence of the sinus, and the discharge may contain active trypsin which leads to self-digestion and a raw painful condition of the skin about the orifice of the drain. On the other hand, if the sinus closes, in a few cases the cyst has reformed.

A. Rendle Short.

PANCREATITIS.—We shall have to consider the prognosis of (1) *Acute pancreatitis*, including the suppurative, hæmorrhagic, and gangrenous varieties ; (2) *Abscess of the pancreas* ; and (3) *Chronic pancreatitis*.

1. **Acute Pancreatitis.**—By this we mean an acute attack of violent pain in the upper abdomen, with some fever and vomiting and it may be diarrhœa, which is of such severity that an exploratory operation is performed and reveals extensive areas of fat necrosis, and a swollen, inflamed, suppurating, hæmorrhagic, or gangrenous pancreas. It is almost impossible to make a diagnosis during life with any certainty apart from the operation findings. It is therefore not feasible to give any account of the prognosis in non-operated cases.

DEATH-RATE AFTER OPERATION FOR ACUTE PANCREATITIS.

	Cases	Cured	Died
Moynihan - - -	11	7	4
St. Thomas's Hospital -	16	7	9
Middlesex Hospital - -	8	2	6
Bristol - - - -	9	0	9
Norwich - - - -	7	0	7
Körte (literature) - -	103	41	62
Körte (personal) - -	34	18	16

Although very grave, the condition is by no means hopeless. Thus Moynihan records 7 recoveries out of 11 operations. At St. Thomas's Hospital, 1907–11, there were 16 cases with 7 recoveries and 9 deaths ; at the Middlesex Hospital 8 cases with 2 recoveries and 6 deaths. On the other hand, at three Bristol hospitals, of 9 cases all died, and Blaxland and Claridge have reported a series of 7 cases, all fatal, at Norwich. Körte finds in the literature 103 cases operated on by fifteen surgeons ; 41 recovered and 62 died. In his own clinic, 34 patients were treated by drainage of the pancreas ; of these, 18 were cured and 16 died. The death-rate is therefore probably about 60 per cent.

The prognosis varies with the following conditions :—

a. *The Time of Operation.*—Thus Körte relates : Operation in first week, 12 cases, 8 cured, 4 died ; in second week, 4 cases, 3 cured, 1 died ; operation in 3rd and 4th weeks, 14 cases, 7 cured, 7 died ; operation later, all died. It would appear, however, that Körte's series must include a number of mild or subacute cases, because in English practice the patient is frequently dead in a week, whether operated on or not.

b. *The Nature of the Operative Interference.*—Mikulicz quotes from a series of cases in the literature, where on 36 occasions the pancreas was actively attacked (by blunt puncture, etc.) and drained, 25 recovering and 11 dying ; in 41 instances it was left alone, and only 4 recovered. Too much importance must not be attached to these figures, because it is probable that the first group contains less acute cases where a definite abscess was found, and that the latter group would include the gangrenous and hæmorrhagic cases where there is little to be done except put a drain down to the pancreas. In Körte's series, 7 cases were drained posteriorly ; of these, 5 died.

c. *The Operation Findings.*—The gangrenous and hæmorrhagic cases are very grave indeed, and seldom recover (2 out of 13 in Körte's clinic).

When there was acute pancreatitis without necrosis or pus, Körte saved 11 out of 14.

It is difficult to mention a time of average survival, because the patients differ so. In many cases they are ill for less than a week before death terminates their sufferings. Others drag on for a month or more ; they are very liable to suffer from self-digestion of the wound, subphrenic abscess, or pneumonia. Körte had 7 cases of severe post-operative hæmorrhage, all but 1 proving fatal. I have lost two cases in this way. One bled regularly every tenth day. Another of my patients did well for a month and left the nursing home, but died later of thrombosis of the inferior vena cava.

The writer has published a case of acute pancreatitis of the accessory pancreas in the wall of the jejunum, which proved fatal in spite of operation.

2. Abscess of the Pancreas.—Although grave, the outlook in this group is by no means so serious as in the acute class just discussed. Abscess of the pancreas is generally the late result of a relatively mild attack of acute suppurative pancreatitis. Körte had 7 cases with 5 recoveries. Villar has abstracted from the literature 53 cases of abscess of the pancreas, whereof 33 recovered and 20 died. Some of those who recovered from their immediate trouble were by no means perfectly cured, but eventually developed symptoms of diabetes, phthisis, or extreme wasting.

3. Chronic Pancreatitis.—We include here those cases in which there is chronic jaundice and perhaps also pain, the diagnosis from gall-stones on the one hand and cancer of pancreas on the other being difficult if not impossible. We do not, in this section, include those cases in which the classical symptoms of diabetes supervene; but there is always the possibility to be borne in mind, in giving a prognosis, that this disease may eventually declare its presence when there is known to be cirrhosis of the pancreas already present.

It is not probable that chronic pancreatitis will get well, apart from operation, when it has advanced so far as to produce persistent jaundice.

Two methods of treatment are possible, cholecystenterostomy and drainage of the gall-bladder. The operation mortality is given by Mayo Robson as 8 deaths in 113 cases from the literature, so that the true mortality may be about 10 per cent—higher, no doubt, after cholecystenterostomy than after simple drainage. Neither operation can be relied upon to give first-class results; the fistula may fail to close, and if the gall-bladder and duodenum have been short-circuited, sepsis may invade the bile-passages from the bowel. Accurate figures are lacking, but probably the majority of the patients are cured by a cholecystenterostomy.

REFERENCES.—Mikulicz, *Ann. of Surg.* 1903, ii, 1; Sampson Handley, *Archiv. Middlesex Hosp.* 1912, Feb. 20; Körte, *Ann. of Surg.* 1912, iv, 23.

A. Rendle Short.

PAPILLOMA OF THE LARYNX.—(See LARYNX, PAPILLOMA OF.)

PAPPATACI FEVER.—(See TROPICAL FEVERS.)

PARALYSIS AGITANS.—This is a progressive, but not a fatal, malady, due to degeneration of the large-celled pallidal system of the corpus striatum. Beginning unilaterally in most cases, it may remain confined to the face and limbs of one side for years; but sooner or later the other side also becomes affected with the characteristic rigidity and tremor. Worry, excitement, business anxiety, and strenuous mental exertion all aggravate its symptoms. The rigid, mask-like face, with its expression of unutterable sadness, not infrequently disguises a cheerful, and even a humorous, frame of mind; although, in other cases, the patient becomes depressed by the consciousness of the inveterate nature of his malady.

The intellectual faculties, however, are usually preserved unimpaired, even in the most advanced stages of the disease. By the judicious administration of hyoscine, we can usually mitigate not only the rigidity and tremor, but the characteristic restlessness which is so trying to the patient.

J. Purves Stewart.

PARALYSIS, BULBAR.—(See BULBAR PALSY.)

PARALYSIS, FACIAL, ETC.—(See NERVE INJURIES.)

PARALYSIS, GENERAL.—(See MENTAL DISEASES.)

PARALYSIS, INFANTILE.—(See INFANTILE PARALYSIS.)

PARANOIA.—(See MENTAL DISEASES.)

PARATYPHOID FEVER.—There are two varieties of this disease, one due to the *Bacillus paratyphosus A*, the other to the *Bacillus paratyphosus B*. Before the great war the former was met with in Asia, especially India, and not in Europe; the latter, on the other hand, occurred in Europe and was rare in Asia, and even in Europe was not common compared with typhoid. When, however, the epidemics of 'enteric' fever

broke out in 1915 amongst the armies in Belgium and France and the Near East, not only did cases of paratyphoid appear in larger numbers than before, but paratyphoid A was met with as frequently as paratyphoid B.

The fatality of paratyphoid A for all ages before the war was estimated by Bainbridge (1912) to be about 2 per cent, and that of paratyphoid B about 3 per cent. Speaking generally, amongst the military cases the fatality of paratyphoid (A and B together) was about 3 per cent, certainly not higher than 4 per cent, but it varied in different groups of cases from below 1 to over 11 per cent. Still, even the highest rate was much lower than that of typhoid amongst males of military age (about 22 per cent), so there can be no question that at the worst paratyphoid is a much less severe disease than typhoid.

There is a difference of experience concerning the relative fatality of the two forms of paratyphoid in the military cases; the English observers appear to have found paratyphoid A, the French paratyphoid B, the more severe.

Death is usually due to some complication, and complications are, on the whole, not so frequent as in typhoid. Hæmorrhage, rarely severe, occurs in not more than 5 per cent of the cases of both varieties, perforation in less than 1 per cent, nephritis in 4 per cent, rheumatism in 8 per cent, and phlebitis in 4 to 5 per cent. Pulmonary complications are not very infrequent, and boils and abscesses are common. Relapses take place fairly often—in 7 to 10 per cent.

In paratyphoid the febrile stage may be of several weeks' duration, and, as in typhoid, recovery is slow. It has not been shown that vaccine treatment makes the prognosis more favourable.

It must be remembered that the statistics from which these figures have been taken relate to military cases occurring during the war, and that other factors connected with the conditions of military service may well have had an influence on the character of these diseases.

Paratyphoid can only very rarely be distinguished from typhoid fever, except by bacteriological examination of the blood, stools, and urine, or by careful agglutination tests.

E. W. Goodall.

PAROTID TUMOUR.—The nomenclature of tumours of the parotid gland is in a very unsettled state, and it will be necessary to define terms before considering the prognosis of the varieties of growth. The submaxillary and sublingual glands are liable to exactly the same forms of new growth as the parotid.

It is customary to describe the following varieties: adenoma, carcinoma, sarcoma, melanotic sarcoma, and mixed parotid tumour or endothelioma. Chondroma, fibroma, etc., have been reported two or three times each. Now of these, it is admitted that *adenoma* occurs; it is very rare, and is of course innocent, but is said to have a tendency to develop into carcinoma. *Alveolar carcinoma* is not uncommon, grows rapidly, infiltrates lymph-nodes, forms metastases, and recurs promptly after removal. Sometimes the cells are closely packed, small, rounded or spindle-shaped, and have been incorrectly termed sarcoma (Ewing). True sarcoma, except possibly melanotic, does not occur.

The *mixed parotid tumour*, usually containing cartilage, fibrous tissue, mucoid areas, and epithelial cells, is much the commonest growth of the salivary glands. Modern pathology doubts the theory that it is an endothelioma, and is inclined to favour the view that it really arises in the glandular epithelium, and that the cells thus derived are susceptible to cartilaginous and mucoid degeneration. The growth does not invade lymph-nodes or form metastases.

Its course is peculiar. For a period, which may be months or may be many years, it grows slowly and behaves as innocent. Then it may suddenly assume malignant characters, grow rapidly, and infiltrate the facial nerve. If it is *completely* removed, it does not recur; but Butlin and others have reported cases of apparently complete removal followed by recurrence in a more active form, with metastases and invasion of the lymph-nodes in a few instances. Wood reports 37 cases operated on: 17 recurred (= 45 per cent), and 20 were cured. Of the 17 recurrences, 12 were cured by a second operation. Some of them returned many years after the first intervention; others were cellular and malignant.

A. Rendle Short.

PELIOSIS RHEUMATICA.—(See PURPURA.)

PELLAGRA.—Pellagra varies greatly in its type, the prognosis being grave in acute cases, but fair in the more chronic forms. According to Lombroso, the mortality among 13,000 cases in Italian hospitals in 1883-4 was 13 per cent, but in 1895 among 55,029 cases collected by Wollenburg it was but 4 per cent, while Sandwith recorded a similar figure in non-insane pellagrins in Egypt. In America the disease is more severe, the death-rate having been about 15 per cent among 636 insane pellagrins, although according to Bass it is becoming milder in New Orleans. Roberts gives the mortality in the United States as 50 per cent in asylums and about 25 per cent in general practice, but thinks it will become less in time.

In individual cases, bad indications are acute dermatitis with vesicles, a pulse over 120 while in bed, a temperature over 100°, especially with delirium, continued diarrhœa with rapid loss of flesh, and prostration. Steady gain in weight is the most favourable sign, although it is impossible to say in a given case whether a relapse will occur in the ensuing spring. Recent work in America indicates that the disease is due to the deficiency of certain elements in the diet, by supplying which it can be cured. Thus, in an American asylum with 4000 patients, pellagra has been banished from those wards in which an increased protein diet in the form of extra animal food was given, although the disease continued unabated in control wards with no dietary change. The recovered cases did not relapse in the following spring, and so appear to be cured (Goldberger).

On the other hand, the Thompson-McFadden Commission maintain that pellagra is an infectious disease, which can be almost entirely arrested by a proper sewage system (Silas).

Transfusions of blood have also been reported as having proved curative in America.

Leonard Rogers.

PEMPHIGUS AND PEMPHIGOID AFFECTIONS—It is important to make clear exactly what diseases are included under the term pemphigus before endeavouring to estimate prognosis. The description 'pemphigus' has been applied to many eruptions characterized by the formation of bullæ or blisters, but the use of the word is now more limited. Recently the convenient term 'pemphigoid' has been coined to cover certain allied conditions which will be considered here.

Pemphigus Neonatorum is a bullous variety of impetigo occurring in newly-born infants. The eruption is chiefly on the trunk, and is often associated with a septic condition of the umbilicus. The mortality is about 30 per cent. The cause of death is generally septicæmia or pyæmia, the infection becoming generalized through the umbilical stump. Provided the lesions are confined to the skin, and that they are properly dressed with antiseptic ointments, the outlook is not unfavourable.

Pemphigus Contagiosus is the name given to a bullous impetigo which is most commonly seen in the tropics, but is occasionally met with in this country. The eruption consists of large blebs filled with a serous fluid at first, but subsequently the contents may become purulent. To this eruption the name pemphigus is often given, and many of the so-called mild cases of the disease are of this type. The eruption usually yields rapidly to antiseptic treatment.

Epidermolysis Bullosa (so-called **Hereditary Traumatic Pemphigus**) is a rare affection, characterized by the formation of blebs containing serum or blood, caused by slight friction or pressure which, in the normal subject, would be unattended with any reaction whatever. It varies very much in its severity, and various degrees are often seen, in several members of the same family and through several generations. If severe, it may incapacitate the sufferer from doing ordinary labour throughout life. In the less severe cases, it is a constant source of annoyance and a hindrance to work. Moreover, the abraded surfaces are liable to infection. Though the disease must be looked upon as incurable, there are cases in which the development of the blebs becomes less marked with the approach of puberty.

Dermatitis Herpetiformis.—This affection is one of the most troublesome in the domain of dermatology. It is characterized by the development of a polymorphic eruption, consisting of erythematous areas with groups of herpetiform vesicles or bullæ of variable size. The eruption is attended with great irritation, and sometimes with pain.

It tends to develop in early life, and may persist for many years. The attacks occur at intervals, and vary greatly in their severity. In some cases the periods of intermission are very short, so that the sufferer is rarely free from the eruption; in others, there are long intervals between the attacks. An attack can usually be controlled by arsenic, pushed to the capacity of the patient, and by ointments containing sulphur. In some instances the patient is able to carry on his avocations owing to the limited area affected; in others an almost complete incapacity is produced. We are ignorant of the cause of the affection, and are, therefore, unable to do more than temporarily relieve the condition.

Hydroa Gravidarum or **Hydroa Gestationis** is dermatitis herpetiformis occurring in pregnant women. It commonly appears between the third and sixth month, and often recurs with successive pregnancies; as a rule, the severity of the disease increases with each succeeding attack. In many cases the eruption clears up soon after the delivery of the child; but in some instances the disease may start after parturition. It is rare to find the condition so severe as to determine the pregnancy, and recovery is the rule.

Pemphigus Acutus.—This is a rare affection occurring in butchers and others who handle dead carcasses. It is believed to be due to a diplococcus, which has been isolated by Bulloch and others. The prognosis is extremely bad. The symptoms are those of a grave septicæmia, and death occurs in 75 per cent of the cases, in from one to three weeks after the onset of the disease. In the minority of the cases, convalescence begins in from three to four weeks.

Pemphigus Chronicus.—This disease, which is somewhat rare, is of grave prognosis. Of 30 cases admitted with this diagnosis into the wards of the London Hospital, 19 died, but this does not represent the entire mortality, because several cases running a very chronic course were removed to the infirmary and died there. It is exceedingly difficult to state at the onset what course the affection is likely to run, for many cases begin with a limited eruption, which gradually extends in spite of treatment. As a rule, the younger subjects are most likely to recover. The fatal issue usually occurs in from three to eighteen months, but in some cases a longer course is seen, the disease passing on to pemphigus foliaceus.

Pemphigus Foliaceus.—This variety of pemphigus is characterized by the formation of flaccid bullæ, followed by a condition of general exfoliation of the skin. It may be primary, or the sequel of the chronic form of pemphigus, or rarely of dermatitis herpetiformis.

The course is chronic, and the affection may persist, with exacerbations and remissions, for two or three years or longer. A fatal issue is brought about by gradual asthenia, diarrhœa, or some intercurrent disease.

Pemphigus Vegetans.—This is an exceedingly rare disease, characterized by the formation of bullæ on the base of which vegetations rapidly develop. The fatal issue usually occurs in from two to six months. Though nearly always fatal, a few cases occur in which the eruption is limited to the limbs and trunk, and runs a benign course.

J. H. Sequeira.

PENIS, CARCINOMA OF.—Prognosis always depends upon accurate diagnosis, and therefore it will be necessary, before giving an opinion as to the outlook, to make certain that the condition is not a tertiary syphilitic ulcer, primary chancre, or mass of hard warts, all of which are, of course, curable conditions.

Epithelioma of the penis is not a particularly malignant variety of cancer. Apart from operation, it always leads to a fatal termination, usually in two or three years, but cases lasting five or even ten years are on record. The cauliflower type of growth is not so rapid as the deeply ulcerating.

Various methods of operative treatment are in use, such as: amputation of the penis; extirpation of the penis (Pearce Gould's method); one of the above with bilateral removal of inguinal glands, either at the same time or subsequently.

Mere amputation of the penis, except in a broken-down subject is a trifling operation. At St. Bartholomew's Hospital, prior to 1900, there was 1 death in 53 cases. The mortality of Gould's operation at that time was said to be 6 per cent. Clearance of the groin glands would, no doubt, add to the risk to some extent, but the immediate danger to life depends far more on the general health of the individual than on the exact nature of the operation.

The end-results were worked out by Butlin¹ in a series of 65 cases treated, prior to 1900, by simple amputation of the penis, usually without clearance of the inguinal glands. Of 65 cases followed three years, 23 were still free from recurrence, or 35 per cent. There were no difficulties with micturition, and coitus was still possible for some of them. The principal factors in prognosis are the rate of growth up to the time seen and, especially, whether the groin glands are palpably enlarged; if they are, the outlook is much more serious than in cases where they cannot be felt.

Of 9 recurrent cases, in 3 the growth returned in the penis, and in 6 in the groin glands only. This is, of course, a strong argument for clearance of the inguinal region. It also demonstrates that total extirpation of the penis by Gould's method need only be adopted for extensive growths, because there is no great tendency to spread back in the corpora cavernosa. It would no doubt be wise, and it is quite possible, to remove the lymphatics of the deep fascial plane in a continuous sheet, from the growth to the inguinal glands, by a dorsal incision along the penis. In an advanced case, the complete emasculation operation described by Binnie is the best.

Even if the patient is not permanently cured, amputation of the penis is nearly always a great relief to him.

A study of 100 cases operated on between 1872 and 1905 at the Massachusetts General Hospital has been published by Barney.² He points out that recurrence after operation may be quite late; 39 per cent of the relapses are in the first year, but 12 per cent are over five years. Pearce Gould's operation gives no better results than simple amputation. Only one patient out of the 100 died in hospital. Very few patients (2) were cured when the groin glands already showed cancer microscopically.

End-results were known in 90 cases. Of these, 27 were 'cured'—that is, alive and well for many years after—or else died of old age over five years later—and 15 more died, not of cancer, within five years. One of these died in hospital of sepsis. One patient refused operation and was alive eleven years after. Twenty-two died of cancer without another operation, the average period being twenty-four months after removal of the growth. Twenty-six recurred, and 24 of them had a further operation, out of which 11 were 'cured' (alive and well, average period twenty-four years after), 4 died of other causes, and 10 died of cancer, the average time from first onset to death being over eight years. Nearly all the recurrences were local, not in the groin glands.

RESULTS OF OPERATION FOR CARCINOMA OF PENIS.

Reporter	Cases followed	Cured	Died, not of cancer	Died of cancer	Recurred, but cured by second operation
Butlin - -	65	23	—	—	—
Barney - -	90	27	15	33	15*

*4 died, not of cancer.

We may, therefore, conclude, on the whole, that the mortality of operation is about 1 per cent, and that nearly half the patients have been cured even by the inadequate methods of many years ago. A second operation for recurrence seems to save another third. Probably quite two-thirds would be saved by present-day surgery.

REFERENCES.—¹Butlin, *Operative Surgery of Malignant Disease*, 2nd ed.; ²Barney, *Ann. of Surg.* 1907, xlvii, 890.

A. Rendle Short.

PERICARDITIS. (See also RHEUMATIC PERI-, MYO-, AND ENDOCARDITIS.)—Nowhere is a knowledge of etiology and pathology more essential to clinical accuracy than in pericarditis. It is quite futile to attempt a forecast of the probabilities in a case of pericarditis without knowing how it began. There are two reasons for this. First, the lesions underlying or associated with pericardial inflammation may have far more bearing on the course of the case than the pericarditis itself. Second, inflammation of the pericardium runs a very different course according to the cause.

The commonest of all the forms of pericardial inflammation is that which is associated with *rheumatic carditis*. As this is discussed under a separate heading, no more need be

said here than will serve to bring it into line with the other types. First, it is scarcely accurate to speak of rheumatic pericarditis as if it were of itself a disease. It is never more than one feature of that which includes it—namely, rheumatic pancarditis. When the rheumatic infection attacks the heart, the muscle and the mitral valve are always injured, the pericardium nearly always, and the other valves sometimes. When the pericardial inflammation is sufficiently intense, it gives rise to an audible rub. This is so striking a feature of the case that it is labelled 'pericarditis', and the fundamental fact that the whole heart, and not the pericardium only, is damaged, is lost sight of. Second, the fact that there are signs of pericarditis is nevertheless of considerable prognostic importance, for it is a proof that the dose of infective agent that has been cast into the heart by its coronary blood-supply is a large one. The mortality of cases in which a rub is heard is much higher than in cases of rheumatic carditis without friction (20 per cent, as compared with a mortality certainly under 10 per cent even if only severe cases be included). Third, the permanent disabling of the heart is greater in cases of rheumatic carditis with implication of the pericardium than it is in those that show no signs of pericarditis, for a certain amount of adhesion is an inevitable result of rheumatic pericarditis. The extent to which these adhesions inflict real disability on the heart is doubtful; some allusion to this matter will be made below. Finally (and this also will be discussed below), effusion into the pericardial sac is a very rare complication of rheumatic carditis. Most of the cases in which this used to be diagnosed were in reality cases of acute dilatation due to myocarditis. The whole import of rheumatic pericarditis, therefore, is that it is a sign that the attack of carditis of which it is one feature is a severe one. In general, the more definite and intense the signs of pericarditis, the worse is the outlook; but the state of the myocardium is far more important than that of the pericardium, and it is in this direction that one should look for guidance in prognosis.

A second type of pericarditis is that provoked by the *pneumococcus*. This may occur as a complication of lobar pneumonia in adults, or in small children in connection with empyema. In the latter group it is difficult to detect and equally difficult to treat; the results are therefore very bad. The examples of accurate diagnosis and early operation are very few; whereas suppurative pericarditis is a fairly common complication of pneumococcal empyema in infants and young children.

Of 102 cases complicating lobar pneumonia collected by various writers, 70, or 68 per cent, ended fatally. This of course excludes cases in which the diagnosis was only made post mortem. In both types of case it is possible that operation facilitated by early diagnosis might not have saved many lives; for when pericarditis occurs in small children, the patient is nearly always very ill as a result of an empyema, of which the pericardial lesion is only a complication; and the adults who show signs of pericarditis with their pneumonia are often of the type that resists the original disease badly. Moreover, the pneumococcal effusions are seldom large, so that even if operation were more often possible it might not add a great deal to the patient's chance of recovery. Still, the fact remains that if there is an effusion of any bulk, nothing but operation can save the patient's life. The choice of operation will be considered below.

Cases of *tuberculous pericarditis* do better so far as the immediate results of operative procedure are concerned. It is true that of 42 cases so treated, only 11 were regarded by those who report them as being cured; but this is because in many instances temporary amelioration was followed by aggravation of the lesions in other organs. Tuberculosis of the pericardium is nearly always part of a more general infection, and it is on this fact that the prognosis largely turns. There are two kinds of cases, the chronic adhesive and the acute exudative; the former complicates the more chronic form of pulmonary tuberculosis, the latter arises as the result of generalized infection. The patient's chances of survival turn in part only on the course of his pericardial infection, if there be tuberculosis of other tissues. If it be merely one event in a generalized miliary tuberculosis, it is obvious that the only prognostic importance of signs of tuberculosis of the pericardium is that they reveal something of the intensity of the infection, and by that much add to the gravity of the prospect.

Much the same is true of the pericarditis which may complicate the various forms of *septicæmia* and *pyæmia*. In many cases, no doubt, it is only at the post-mortem that these lesions are found. This fact was borne in upon the writer some years ago, in the

course of an investigation into the cardiac lesions of pyæmia. The number of cases of pyæmia recorded in the autopsy books of the old pre-antiseptic days of surgery was in itself a revelation; and in a very large percentage of these the pericardium contained pus. Nowadays this type of pericarditis is happily less familiar, but we encounter it sometimes as a feature of puerperal septicæmia, acute osteomyelitis, and the like. When it occurs under these circumstances, pericarditis is of necessity a grave factor in an already unpromising situation, since it furnishes evidence that the circulating blood is saturated with micro-organisms. But this does not carry with it an immediate sentence of death, for the literature contains several instances of recovery after surgical treatment of pyopericardium due to this type of infection. It is true that in most of these cases death has not been long delayed. Some other lesion of a vital organ, arising from the same infective process, kills the patient, even though the pericardium has been successfully drained.

Pericarditis is an occasional complication of *typhoid fever*. It is not invariably fatal; two of the three cases observed by Thayer recovered.

The same is true of pericardial lesions provoked by *gonococcal* infection; in the case recorded by Robin and Fiessinger, recovery followed paracentesis.

In the pericarditis of *scarlet fever* the prognosis depends on the nature of the organism provoking it. If the pericardial inflammation be but one incident in the course of a severe septic scarlatina, its importance is that it adds to the gravity of the prognosis. If it arise during or after convalescence, it is most probably rheumatic, and the prognosis is that of acute rheumatic carditis.

Four other forms of pericarditis remain to be considered. The so-called *terminal* cases, due to streptococcal and staphylococcal infection, and complicating chronic diseases, especially renal disease, are not always fatal. It is impossible to set this statement on a statistical basis, because there are two facts which vitiate any calculations—the difficulty of discerning between true pericarditis and mere hydropericardium, and the very small percentage of pericardial lesions of this type which are diagnosed during life. In general it may be said that the appearance of pericarditis in any chronic disease such as diabetes, Bright's disease, or cancer, adds substantially to the immediate risks, the chance of survival depending almost entirely on the general condition of the patient at the onset of the pericarditis.

In *traumatic pericarditis* the outlook naturally depends on a variety of factors, apart from the state of the pericardium itself. Limiting our consideration to the pericardial lesions as far as possible, we find that, if all cases be included, the mortality is about 40 per cent. If only those cases be counted in which the injury has failed to penetrate the chest wall, it seems that about three-quarters get well. In the open cases the occurrence of air in the pericardium is not necessarily fatal.

When the pericardium becomes implicated in *malignant disease* arising within the thorax, signs of pericarditis may become manifest. In such, a promise of immediacy is added to an already fatal prognosis. This is particularly true of perforation of the cancerous œsophagus into the pericardial cavity.

Last of all, there is the pericardial rub which, appearing suddenly in a case of *chronic myocardial disease*, furnishes proof of some gross lesion of the cardiac wall—thrombosis, embolism, or rupture. This is always a sign of the utmost gravity, for even if the patient be not immediately destroyed, his survival cannot be more than brief.

But it is not only as a revelation of sinister forces that pericarditis carries a threat of death. The rapid collection of fluid within the pericardial sac may kill the patient. There is also the formation of adhesions, and their influence on the cardiac efficiency, to be thought of. Acute sero-fibrinous pericarditis cannot of itself kill the patient; but it does on the one hand prove the existence of certain collateral dangers, such as rheumatic myocarditis; while on the other hand it threatens more or less directly to hamper and possibly overcome the heart by leading to pericardial effusion or adhesion.

Effusion into the pericardium, in amounts sufficient to endanger the life of the patient, is a very rare result of rheumatic infection. Some eminent observers declare that it never amounts to enough to call for paracentesis. There are, however, a number of cases of the kind in which it has been thought necessary to puncture the sac. In these the results were roughly as follows: the course of the case was not materially altered in about 50 per

cent; in 25 per cent there was some transient improvement; while in the remaining 25 per cent paracentesis appeared to give material and lasting relief from a condition of urgent peril. The writer has never seen a case of rheumatic pericarditis in which the operation would have been justified, either by the signs during life or by the post-mortem findings. In the series of cases of effusion into the pericardium brought forward at the Royal Society of Medicine discussion in 1910, there were only 9 rheumatic cases in which it had been thought advisable to empty the sac, and in only 3 of these was life prolonged by the proceeding. Clear effusions are perhaps more characteristic of tuberculosis than of any other infective process, but they are often semi-purulent in this disease. As has been already remarked, the immediate outlook in those cases of tuberculous effusion that are diagnosed during life (about 6 per cent of all cases) is fairly good; the choice between paracentesis and pericardiotomy seems to depend on the character of the fluid, the former procedure sufficing for the clear cases, while the more elaborate operation is called for if the exudate be puriform. At any rate, the results in the published cases, in which this rule seems to have been roughly followed, work out about equal. It should be added that if the exudate be hæmorrhagic, this is no contra-indication to paracentesis, as cure has followed the operation in several such cases. This is true of pericarditis due to other infections beside tuberculosis. The dangers of simple hydropericardium are as a rule overshadowed by the more direct risks implied by the underlying lesions, and the outlook is therefore that of the cause.

Pyopericardium is a desperately dangerous disease, whatever the infection that is responsible for it. The risks are, first, those due to such other lesions as the causal infection may have provoked; second, those that arise from the fact that purulent pericarditis is very difficult to detect (in only 6 of Poynton's 100 cases in children was it diagnosed during life); third, those that are due to the risks of surgical treatment, the only form of treatment that can hold out any hope of cure; and finally, those that are included within the possibility of increase of the effusion to the point at which the cardiac movements become fatally hampered.

Suppose the condition has been detected in a patient who is fit to be operated on; what plan of treatment promises the best results? The figures published by various writers, and tabulated in Blechmann's excellent monograph, show that mere paracentesis has never saved life; that the percentage of survivals after incision of the pericardial sac is about 46 in a total of nearly 100 recorded cases; that the recovery rate following simple incision is 28 per cent; after pericardiotomy with costal resection, 55 per cent; after operation through the epigastric incision recommended by Ogle, 66 per cent. These figures demonstrate clearly the superiority of the methods in which free drainage is secured. Such figures as are available are not very convincing as to the advisability or otherwise of drainage in pericardial tuberculosis; but the general opinion of surgeons and physicians, expressed at recent discussions, is to the effect that if incision be practised at all, it should be sewn up and not left to drain.

In *pneumopericardium* the outlook is of necessity dependent to a large extent on the antecedent conditions; and as it often forms a late incident in a morbid process that would be sufficiently desperate even if there were no irruption into the pericardium, it is not to be wondered at that the death-rate is high—28 out of 43 cases (Cowan, Harrington, and Riddell). The more abrupt the invasion of the pericardial sac, the worse the prognosis.

There remains to be considered the vexed question of *chronic adhesive pericarditis*. This is met with under several sets of circumstances. In the cardiac rheumatism of childhood, some adhesion is very common (in three-quarters of Poynton's autopsy cases, and nearly half of the writer's). In the various forms of chronic indurative mediastino-pericarditis the sac is more or less obliterated. A third group of cases is that embraced within the term 'polyserositis'. These may be due to tuberculosis or to no obvious cause.

It would at first sight appear to be a simple matter to accept the position that adherent pericardium is always a serious condition; but there are two considerations that complicate the issue. In the first place, all the diseases named inflict other disabilities on the heart or other vital organs, and it is difficult to separate these from the direct effects of pericardial adhesion. In the second place, the fact that the pericardium is adherent is by no means always discoverable clinically. The rheumatic type of case is by far the

commonest, and here there is, in the writer's opinion, no reliable sign of pericardial adhesion. Of all the phenomena that have been described as pointing in this direction, there is not one that may not be present in the absence of adhesion; and it would seem that all of them are due rather to the great cardiac enlargement that is so constant a feature of just those cases in which post-rheumatic adhesion of the pericardial sac is likely to occur—in the adolescent or young adult who has just managed to survive repeated attacks of acute rheumatic carditis, though with a heart much enlarged and otherwise crippled. Be this as it may, the fact no doubt remains that in those cases of post-rheumatic disease in which there are adhesions not only obliterating the pericardial sac but also binding the epicardium to the neighbouring tissues, the heart carries on its work far less efficiently than in cases where there are only valvular disabilities to be overcome. If, therefore, the clinician feels himself in a position to diagnose this condition in a case of post-rheumatic heart disease, the prognosis he must form will be much graver; patients in this class of case rarely attain the age of thirty. In the non-rheumatic type of case the prognosis is to be reached along the same lines; if there be signs of adhesion uniting both pericardial layers into one membrane, and that again into inseparable fusion with the surrounding tissues (and nobody claims to be able to diagnose mere intrapericardial adhesions), then the prospect of cardiac failure, within a few years at the outside, is added to such other portents as the disease in its attack on other organs may furnish.

The main interest of the question as to the influence of treatment on prognosis centres around the effect on the patient's outlook of the operation described by some as cardiolysis, but more accurately by others as thoracostomy. Of 30 cases of which the writer was able to collect the reports, only 1 died as the immediate result of the operation; of the remainder, 7 were described as receiving little or no benefit, while in the remaining 22, various degrees of improvement were observed. In reading these records, one is struck by the fact that the disappointments occurred principally in the rheumatic cases, and operations of this kind are not likely to be practised in the future for such cases, except perhaps as giving space to an enlarged heart. The cases most likely to benefit from this operation belong to the polyserositis group.

Carey F. Coombs.

PERIOSTEAL SARCOMA.—(See BONE TUMOURS.)

PERIPHERAL NEURITIS.—(See NEURITIS.)

PERITONITIS, PNEUMOCOCCIC.—There are two very definite types of this rather uncommon disease, the prognosis in the one being grave, and in the other remarkably favourable. These are (1) *The diffuse or acute type*, and (2) *The encysted or chronic*. Either of these may or may not have been preceded by an attack of pneumonia. The diagnosis can only be regarded as certain when the pneumococcus is found either at operation or autopsy, or, in a few cases, when the pus leaks away at the umbilicus.

1. Acute Diffuse Pneumococcic Peritonitis.—Of the 91 cases from the literature reported by Annand and Bowen, 46 belonged to this variety. Of 25 cases at the Bristol Royal Infirmary and General Hospital, 20 were acute.

The patients are almost all little girls. They present the clinical picture of an acute general peritonitis of rapid onset, often accompanied by a marked tendency to diarrhoea. In about half the cases there is evidence of pneumonia beginning a day or two previously. The diagnosis of appendicitis with general peritonitis is usually made, but there is no special localization of pain or tenderness in the right iliac fossa.

The prognosis is very grave indeed. Rischbieth quotes 45 cases, all of which died. Of the Bristol cases, 15 out of 20 died. In Annand and Bowen's series, 6 recovered and 40 died. All the Bristol cases except 2, both fatal, were operated on; in Annand and Bowen's list, 18 were operated on and 6 recovered. Cameron's series of 20 cases from Guy's Hospital shows 12 operated on, of whom 3 recovered; 8 others died without operation. The three recoveries each had a second operation to evacuate a residual abscess. The prognosis is not greatly affected by the question as to whether there has been a previous pneumonia or not. If death is going to occur, it is usually within a week or two. Early operation is probably valuable. Out of the last eight cases at the Bristol Royal Infirmary (1915–1921), four have recovered after early opening up and brief drainage.

In practice, it might be very difficult to give a prognosis because of the uncertainty of the diagnosis before operation; but when there is generalized tenderness of the abdomen with marked rigidity, pain, fever, and diarrhoea, the only diagnoses reasonably probable in a little girl are perforative appendicitis and this disease, and in both the outlook is serious with immediate operation, and hopeless without. One should make certain that there is not a gonorrhœal vulvovaginitis present, because gonorrhœal peritonitis is decidedly more favourable.

PNEUMOCOCCIC PERITONITIS.

Author		Cases	Recovered	Died
Acute diffuse form	Annand and Bowen, operated	18	6=33·3%	12=66·6
	" not operated	28	0=0%	28=100%
	Bristol - - - - -	20	5=25%	15=75%
	Rischbieth - - - - -	45	0=0%	45=100%
	Cameron - - - - -	12	3=25%	9=75%
All cases	St. Thomas's Hosp. 1907-11	16	9=56·29%	7=43·8%
	Carmichael - - - - -	20	13=65%	7=35%
Chronic encysted form	Annand and Bowen - - - - -	43	37=86%	6=14%
	Bristol - - - - -	5	4=80%	1=20%

2. Chronic Encysted Pneumococcic Peritonitis.—In this very interesting and remarkable disease, one is confronted with the strange sight of a large cavity in the abdomen containing, it may be, pints of pus, surrounded by intestines, liver, and stomach all matted together, and yet the patient is singularly little affected. In one of four cases seen by the writer, the abscess quietly burst at the umbilicus before the girl was sent to hospital; in two others, sisters, the temperature was but little raised, and the patient did not look ill. They came under observation about a week after the onset of the abdominal pain and swelling, and both had had pneumonia. The pus has not an offensive odour, and is thick and creamy.

The great majority of the cases are operated on and recover. In Annand and Bowen's series of 45, the result was known in 43, and of these 37 recovered. Only one of these was not operated on; in this patient the pus burst forth at the umbilicus, and recovery took place. Four out of five Bristol cases of this encysted variety recovered; one of them has subsequently developed abdominal pain, presumably due to adhesions.

Probably the majority of the cases of pneumococcic peritonitis at St. Thomas's Hospital, 1907-11, were of this type, inasmuch as 9 out of 16 were cured. The same applies to the Edinburgh Children's Hospital series described by Carmichael.

REFERENCES.—Annand and Bowen, *Lancet*, 1906, i, 1591; Rischbieth, *Quart. Jour. Med.* 1911; Noon and Moreton, *St. Bart.'s Hosp. Rep.* 1912, 137; *St. Thomas's Hosp. Rep.* 1907-11.

A. Rendle Short.

PERITONITIS, SEPTIC.—The prognosis of local and diffuse peritonitis is considered under its causative headings (*see* APPENDICITIS; STOMACH, SURGICAL DISEASES OF (Gastric Ulcer, Perforated); PERITONITIS, PNEUMOCOCCIC; PERITONITIS, TUBERCULOUS); but there are some general considerations which may be found useful.

Recovery from a widespread peritonitis apart from operation is probably not so rare as some surgical teaching would lead one to suppose, though of course it is bound to be very exceptional. It is remarkable how small an intervention may suffice to save some cases; in a patient under my care, who had extensive bronchitis and evidence of practically universal peritonitis following appendicitis, all I dared do was to make a small suprapubic opening for drainage under local anæsthesia, but the child recovered.

It is well known that the prognosis of peritonitis in the lower abdomen—e.g., of pelvic origin—is much more favourable than when the upper abdomen is involved.

A very important prognostic factor is the degree of intestinal paralysis. Incessant vomiting is grave; on the other hand, if the bowels are opened, the outlook is immensely improved. These are the most important symptoms in judging of the patient's chances. There is a type of case—one variety of which Mr. Sampson Handley has described under

the name of *ileus duplex*—often following operation, in which, after a local peritonitis, usually pelvic or appendicular, the coils of small intestine, and sometimes colon also, become matted in the pelvis, producing what is virtually an intestinal obstruction, partial at first, and becoming absolute in the course of a few days, with immense distention of the abdomen. The outlook is always grave, unless there is a definite residual abscess which can be evacuated. If aperients, pituitary extract, physostigmine, and enemata do not soon relieve, the patient's best chance will be to have another operation, which may be a short-circuiting, a temporary colostomy, or merely a freeing of the coils of small gut. About half the cases can be saved by one of these means.

Assistance may be given in the prognosis of an acute peritonitis by a bacteriological and cytological examination of the exudate. A *Staphylococcus albus* infection is very favourable; *B. coli* and *Staphylococcus aureus* give average results; *Streptococcus* and *B. pyocyaneus* are nearly always fatal (Dudgeon and Sargent). Quicker, and therefore of more clinical value, is a cytological examination. Some surgeons use this to help them to decide whether to close the abdomen or to drain. The normal sequence is that bacteria are extravasated and multiply: at first in the free state; then leucocytes appear on the scene and ingest the bacteria more or less successfully; and, thirdly, macrophages are found to effect processes of repair. The presence of many free germs, therefore, except within an hour or two of the catastrophe, is nearly always a sign of a fatal issue; if macrophages are present, and all the germs are intracellular, the patient will recover.

A. Rendle Short.

PERITONITIS, TUBERCULOUS.—It is very difficult to appraise correctly the relative value of medical and surgical treatment in this disease.

Results of Medical Treatment.—We will first collect the evidence as to the outlook when cases are treated by medical means only. There is no lack of statistics of a sort, but many of them are vitiated by ill-arrangement, inadequate details, or too early reporting. Thus Faludi, by adding up a mass of German reports, quotes 156 cases treated without operation, of which about a third got well; but we do not know for how long a time they were watched. The writer has obtained details of 21 cases treated in various institutions in Bristol by fresh air, iodoform, mercurial ointment, cod-liver oil, etc. All of these were followed for at least two years, and most of them for four years or more. Of the 21, 12 were cured, 4 relapsed, and 5 died; one of these last five had an immediate operation just at the end, when death was already imminent. Ochsner, by the analysis of a mass of figures, concludes that half of the cases treated medically get well; but that half of these relapse later, so that only a quarter are finally cured. Borchgrevink followed up 17 cases treated medically; 3 of these died, and 14 were well for two years or more.

It is quite useless to set these figures up as an alternative to those obtained by surgical intervention; for the great majority of the patients treated medically are handed over to a surgeon as soon as it becomes evident that they are not doing well; and it is quite certain, therefore, that the Bristol cases and Borchgrevink's, for instance, are much too favourable, representing, as they do, only those patients who are not bad enough to be operated on.

In an orphan asylum in Bristol, where the physician preferred to treat all cases medically, 6 were cured and 3 died; they were all well cared for from the first, and obtained plenty of fresh air, good food, and skilled nursing; so that these results are probably too favourable. In dealing with this disease, the worst statistical reports are more likely to be correct than the best. It is probably fair to accept Faludi's view, that about one-third will recover, and two-thirds will eventually die, apart from surgical intervention. The illness is likely to be prolonged; it is generally a year or two before they can return to normal life.

Results of Operation.—These are much easier to obtain with some degree of reliability, though here also there is a tendency to report too soon. Most of the figures are taken from hospital records, and may therefore be trusted. In Caird's and Borchgrevink's and in the Bristol series, the patients were followed for more than two years; in Czerny's, the majority were followed over three years, but others for a lesser period; Ochsner's and Bottomley's were traced for one year only.

It will be observed that the immediate mortality varies a good deal; the Bristol cases included two deaths from intestinal obstruction, one from ileosigmoidostomy, and one from perforative peritonitis, and are therefore too high. The true mortality of the operation, in properly selected cases, is not more than 1 or 2 per cent.

With the exception of Ochsner's series, which is reported too soon, the end-results are much the same everywhere; it will be seen that rather more than half are well for two years or more; 40 per cent, approximately, die of some form of tuberculosis; and a certain small number relapse, or are little improved. This agrees with the conclusions of Fenger, but is less favourable than those of Faludi, who claims that of 125 operation cases, 70 per cent were 'cured'; but we do not know for how long. The latest figures from the Bristol Royal Infirmary (1915-19, followed up to December, 1921) show an improvement; of 7 cases traced, all were cured. The patients, however, were lost sight of.

RESULTS OF OPERATION FOR TUBERCULOUS PERITONITIS.

Reporter	Cases operated on	Died within a month	Cases followed	Cured	Relapsed or not cured	Died later
Bottomley -	—	—	24	11	2	11
Borchgrevink -	—	—	22	13	0	9
Czerny -	41	3	38	18	9	11
Ochsner -	32	1	20	15	0	5
Matteson -	53	0	37	17	0	20
Caird -	31	3	17	8	0	9
Bristol hospitals	56	13*	27	18	2	7
Total -	213	20	185	100 (or 54 per cent)	13 (or 7 per cent)	72 (or 39 per cent)

* See text.

The Mayos claim excellent results by removing tuberculous tubes in adult females.

We may sum up, therefore, by saying that, on an average, about a third of the patients will be cured by medical means; and of those that come to operation, about half will be permanently freed from their trouble. Inasmuch, however, as the first of these figures is little better than a guess, the value of operation is not very securely established.

Prognosis in Individual Cases.—There does not appear to be much difference between the results in adults and children. Febrile cases are said to do better than afebrile (Borchgrevink). The more acute the onset, the worse the prognosis (Rolleston).

The type of the disease is of very great importance in this respect. *The ascitic type*, with abundant free fluid, but no adhesions, does best. *The ulcerous type*, with great wasting, a huge abdomen, irregular temperature, and tendency to diarrhoea, only recovers in quite exceptional cases. A faecal fistula is practically a death warrant. *The fibrous or adhesive type* is intermediate. Most of the operation figures given refer to the ascitic type.

Bottomley and Matteson both distinguish between the results of operation on the different kinds, as shown in the following table.

MORTALITY ACCORDING TO TYPE OF PERITONITIS.

Reporter	ASCITIC TYPE		FIBROUS TYPE	
	Cases	Died	Cases	Died
Bottomley -	16	7	7	3
Matteson -	29	10	24	18

Grave signs, in any particular case, are marked wasting in spite of treatment, uncontrollable diarrhoea, and evidence of pulmonary tuberculosis.

In fatal cases, death usually takes place in six months to two years ; those surviving the latter period are likely to recover. It is remarkable how it occasionally happens that even a badly matted abdomen may eventually get well.

Death results from intestinal obstruction, perforative peritonitis, exhaustion from diarrhœa, fæcal fistula, and generalized tuberculosis.

REFERENCES.—Fenger, *Ann. of Surg.* 1901, xxxiv, 771 ; Bottomley, *Boston City Hosp. Med. and Surg. Rep.* 1900, 118 ; Ochsner, *Trans. Amer. Assoc. Surg.* 1902, 191 ; Matteson, *Providence Med. Jour.* 1911, 6 ; Caird, *Edin. Med. Jour.* 1912, viii, 295 ; Discussion, B.M.A., *Brit. Med. Jour.* 1911, ii, 473.

A. Rendle Short.

PERNICIOUS ANÆMIA.—There are few conditions in which the practitioner of medicine finds more scope for the exercise of his prognostic powers than in pernicious anæmia. Death may occur within a fortnight after the patient comes under observation, and, on the other hand, a fatal issue may be delayed for twenty years ; but in spite of this very wide range of possibilities, the skilled observer may be able to assign nearly every case to a place in the acute, the subacute, or the chronic group, the characters and course of which are fairly definite. Even after cases have been assigned to their appropriate class, a careful review of general symptoms, together with a thorough examination of the blood, will enable the practitioner to make further refinements, and he can often predict the course of the individual case with very considerable accuracy. One of the remarkable features of the disease is the occurrence of remissions. They sometimes begin quite abruptly, even although severe symptoms may be present, and their occurrence is often attributed to the exhibition of medicines which had no part in bringing about the improvement.

Remissions may last for months or even years. A patient may undergo as many as half a dozen remissions and relapses. During the remissions, the chief abnormal characteristics of the blood may disappear ; but in many cases a rather high colour-index, or some other special feature, may persist ; the remission may be complete as regards disappearance of symptoms. This is particularly likely in the case of remission following a first attack ; after subsequent attacks, remissions are less likely to be complete, and the patient is most likely to remain, at the best, in a condition approaching or exemplifying semi-invalidism.

History.—It is of prime importance to take into account the cause of the disease. If the cause can be discovered and removed, the outlook is good. If not, the disease will sooner or later prove fatal.

The cases due to *Bothriocephalus latus* can practically all be cured.

Cases which begin during pregnancy and the puerperium are likely to recover if the very dangerous period during which the symptoms are acute can be safely tided over ; we have seen several such cases lately where the fortunate result was due to transfusion. Some cases appear to be due to cancer of the stomach. Little hope can be held out in these, as there is no likelihood of a remission, and, without a remission of the anæmia, operation would be out of the question. When no cause can be discovered, we must judge of the case on the lines laid down in connection with the blood changes.

Another important point in connection with the history is the question of whether or not we are dealing with a first attack. Not only is the chance of a remission greater after a first than after a subsequent attack, but after a first one there is a much greater likelihood that, if a remission occurs, it will be more complete and more prolonged than after a second or subsequent relapse. Due regard, however, must be paid to the kind of attack. A patient suffering from pernicious anæmia of a definitely chronic type, although he never reaches a high standard of health, has a better expectation of life than the patient who has had more than one acute attack with an intervening period of apparent health. Most cases have their type stamped upon them early. In all, there is a history of very insidious onset. In cases of chronic type, the disease gradually advances till an extreme degree of weakness is reached. In acute cases, the more urgent symptoms come on rapidly, but are usually a sequel to a slowly progressive departure from health.

Blood Changes.—In a case doing badly, the behaviour of the blood will vary a good deal according to the acuteness or chronicity of the disease.

In the acute cases, the tendency is for the corpuscles to diminish steadily in number, and for the colour-index to rise or remain high. More and more megaloblasts may appear, and these are often at their maximum just before death.

It is impossible to make any statement as to the lowest red-cell count compatible with life. Many cases die before the count has fallen below 1,000,000 per c.mm. In these it is hardly likely that the anæmia, *per se*, is the cause of death. Renal inadequacy, a pneumonic patch, and a variety of other complications whose existence may give rise to no obvious symptoms, often play an important part in determining the fatal issue. We have seen a case recover where the red cells had fallen to 400,000. The patient in question was practically comatose for nearly a fortnight, and then had a remission which lasted eighteen months. Quinke's count of 143,000 has never been equalled; the patient in that case recovered. Our own lowest count was 200,000, but it was made only a few hours before death.

In cases which are going to recover, the red corpuscles sometimes increase with startling rapidity. There may be a rise of a million a week, although that is exceptional. The colour-index, if it has been high, gradually drops. The corpuscles improve in quality; they become smaller, basophilia and polychromasia lessen, and megaloblasts disappear. A recent case in point was a lady, age 40, whose first count was 800,000, hæmoglobin 25 per cent, colour-index 1·5. Three successive counts at intervals of a week read: 1,050,000, 30 per cent, 1·3; 2,300,000, 55 per cent, 1·19; 3,280,000, 58 per cent, 0·9.

Some of these cases reach a perfectly normal count in every way, and often pass through a stage during which the colour-index is low. It may drop to 0·7 and remain below unity for weeks. This is to be interpreted as a return to the normoblastic type of blood-formation in the marrow, and is an excellent prognostic sign. If the leucocytes at the same time show a tendency to rise to the normal level of 7000 per c.mm., so much the better.

A certain number of cases never reach normal figures for either red or white cells. Many of them have a short period of comparative health and soon drop back again to a condition of serious illness. Others become chronic cases and may last a very long time, with blood-counts far from satisfactory, but with a wonderful degree of freedom from subjective symptoms or active discomfort.

We have been accustomed to group cases of pernicious anæmia as follows, mainly in respect of the blood condition.

1. *Acute Favourable Cases*.—The symptoms are marked. Red corpuscles are diminished, but repeated counts indicate a tendency to rise. Megaloblasts are not very numerous, and are mostly of pyknotic type. Normoblasts are present. The colour-index, on repeated examination, shows a tendency to fall. Polychromasia is not marked. The percentage of polymorphonuclear cells is fairly high, and the white-cell count is not greatly diminished. Myelocytes are absent or few.

In these cases a remission to a fairly normal condition may be expected, and the remission may last for years or months.

2. *Acute Unfavourable Cases*.—Symptoms are very marked. Red cells number about a million, and repeated counts reveal a tendency to fall. Megaloblasts are typical, large, and numerous. Normoblasts are very few or absent. The colour-index is high. Polychromasia is marked. The percentage of lymphocytes is high, and the total leucocyte count is low. Myelocytes are numerous.

In these cases a fatal termination is to be expected in less than three months, and it may occur in less than three weeks.

3. *Subacute Cases*.—Symptoms are fairly well marked. Red cells are usually just over a million, showing considerable variations in number in successive counts. Megaloblasts are fairly numerous. Normoblasts are scanty. The colour-index is high. Polychromasia is present. The percentage of lymphocytes is high, but polymorphs may show an increase during a febrile attack. Myelocytes are fairly numerous.

The average duration of these cases is about two years. Intercurrent disease or acute exacerbations usually terminate the case.

4. *Chronic Cases*.—Symptoms are not well marked. Red cells tend to remain about one and a half or two millions. Megaloblasts are scanty or absent. Normoblasts are

rarely seen. The colour-index is about unity. Polychromatophilia is slight. Basophilic stippling is seldom seen. The percentage of lymphocytes is high. Myelocytes are scanty or absent.

Such cases are often fit to work for perhaps six months in the year. Their chief trouble is weakness. Febrile attacks may occur, but seem to have little effect. Nerve symptoms are fairly common, but their incidence does not affect prognosis. Improvement is rare, but the patient may live for many years.

Not infrequently we are unable to make this classification as the result of a single blood examination. In some of the acute cases it may be impossible to say whether the outlook is favourable or otherwise. In these, a second examination in a week's time will often clear up the difficulty.

Thus, a case where the red corpuscles are under one million per c.mm. rarely continues long at that stage; if at the end of a week they have shown a tendency to fall, we may predict a fairly early termination; on the other hand, if the tendency of the corpuscles is to rise, we generally find that our case will undergo a remission. Further, we may expect that if the symptoms have been severe, with fever, yellow colour, etc., the remission will be very satisfactory, especially if the attack should be the first one. A case of more chronic type, and especially a case in a second or later relapse, is more likely to make less rapid progress, and the improvement will be from invalidism to semi-invalidism rather than to an appearance of complete health.

When a case is at its worst, a very slight alteration in the blood-count may have a very important significance. A rise of 300,000 red cells per c.mm. in a week would almost be sufficient to justify the hope of a remission, and a preponderance of the type of megaloblast with small, deeply-staining (pyknotic) nucleus, rather than the type with large nucleus and open chromatin network, would also be a very favourable sign.

Symptoms.—The incidence of such symptoms as sickness or diarrhœa, increase of the yellow tint, or œdema, does not necessarily affect the ultimate course of the disease, though any of these would add to the gravity of a case in an acute attack. Conversely, the disappearance of gastro-intestinal symptoms is of good omen. The clearing up of the lemon-yellow tint, when it has been present, is always good, as indicating that the toxic affection of the liver is passing off. This clearing up is not necessarily attended by an improvement of the blood.

It is important to keep a record of the patient's weight, if possible, because of the tendency to generalized œdema of the subcutaneous tissue, which does not necessarily show itself specially in the usual sites affected by heart or kidney disease. Thus, a loss of weight associated with a diminution of œdema is a good sign, a gain of weight with increase of œdema is a bad sign, a gain of weight without œdema and with improvement in the blood is a good sign. Œdema of cardiac type is always very bad, and is usually associated with other evidence of heart failure, which requires appropriate treatment, but is rarely recovered from.

Febrile attacks add to the gravity of the condition while they last. The patient may be none the worse, and is sometimes better, after they are over.

Hæmorrhages are a serious sign, but are not nearly so common, even in the worst cases, as text-book statements would lead one to expect. It has been suggested that retinal hæmorrhages are not so serious prognostically as others.

We recently saw a case where pernicious anæmia was complicated by bleeding fibroids. Each hæmorrhage was definitely lowering the blood-count. There were megaloblasts, polychromasia, and basophilic stippling of the red corpuscles. The counts were—red corpuscles 1,370,000, hæmoglobin 56 per cent, leucocytes 4400, colour-index 1.3. We advocated operation, and hysterectomy was successfully performed. A week after operation the red corpuscles numbered 1,600,000, hæmoglobin 43 per cent.

The onset of jaundice is a somewhat serious symptom.

It is probable that all cases suffer from some renal inadequacy. The evidence of this is based on our post-mortem experience; when there is clinical evidence of kidney disease, the prognosis becomes much more serious, except occasionally in the puerperal cases.

Any complication of an inflammatory nature nearly always determines a fatal issue. Patches of catarrhal pneumonia may be present without clinical symptoms, owing to the

failure of the patient to react. When they are discovered, they are to be regarded as likely to shorten the patient's life.

Other complications do not greatly disturb the course of the disease. Three cases of ours, all with a red-cell count of 3,000,000 to 3,500,000, and hæmoglobin 65 to 72 per cent, underwent operation for gall-stones with no ill effect.

Treatment.—There is little doubt that cases placed in favourable surroundings have a better chance of a remission or recovery than those not so fortunately placed. Hospital treatment for the poor, and skilled nursing for the well-to-do, may make all the difference between a favourable and an unfavourable result.

The patient who can take life easily after a first attack is in an infinitely better position as regards expectation of life than one who has to return to either mental or physical work.

As regards medicine, no drug can yet be said to compete seriously with arsenic, and an important element in prognosis is the way the patient responds to it, and the manner in which it is tolerated. Patients who can take such doses as 15 minims of Fowler's or a similar solution thrice daily, are almost certain to do well.

The various organic preparations of arsenic—cacodylate of soda, atoxyl, soamin, arsacetin, etc.—give no better results than Fowler's solution or the liq. arsenici hydrochlor., and in our experience they cause more frequent and more severe toxic results than the pharmacopœial preparations.

Many observers have published the results of treatment by salvarsan and its substitutes. Among those who have been favourably impressed with this drug is Byrom Bramwell,¹ who has published the result of 11 cases. In 4 there was a return to health, in 2 there was marked improvement, and in 1 slight improvement; 2 showed no improvement, and 2 died. The salvarsan was injected into the buttock, and there was a slight febrile reaction in most of the cases. Boggs² has also reported the result of salvarsan treatment in 11 cases. Of these, 2 were practically moribund before treatment, and died. The remaining 9 cases improved. A large number of cases have been reported by other observers; in many instances the results are not nearly so favourable as the foregoing. Our own experience is not encouraging. Before the war we had treated 13 cases with intravenous injections of salvarsan, and 7 cases with intramuscular injections of neo-salvarsan; the intravenous injections were always followed by a febrile reaction, and often by gastro-intestinal disturbance. Of the salvarsan cases, 7 died, 3 improved, and 3 remained *in statu quo*; of the neo-salvarsan cases, 4 died, 1 improved, and 2 seemed to be unaffected. We do not think it can be maintained that the introduction of these drugs has in any way improved the prognosis. Numerous further cases have been treated since the above series was recorded. On several occasions we have 'raced' two similar cases, treating one by salvarsan or galyl intravenously or intramuscularly, the other by arsenic given by the mouth. In nearly every instance the cases treated by the latter method have won. Some of the salvarsan cases showed no improvement, and only began to improve when arsenic was given by the mouth. It is never justifiable to give salvarsan or its substitutes intravenously in severe or febrile cases. In several that we have heard of, death has directly followed this procedure. Intramuscular injection is specially liable to cause sloughing in this disease, probably because of the general impairment of resistance.

An alternative method of giving arsenic is by the intravenous channel, as liq. sodii arsenatis, well diluted, the dose beginning with 4 min., and being increased as indicated. This is almost always well borne, and is sometimes successful when arsenic by the mouth fails, or causes digestive disturbance.

Iron does harm rather than good in most cases of pernicious anæmia; sometimes it does good when the colour-index is low during the course of recovery.

Washing out the bowel with normal saline solution is a measure which may be said to improve the patient's prospects of recovery. The administration of intestinal antiseptics is not of such proved benefit.

Among other measures which have been suggested are the administration of bone-marrow, the injection of antistreptococcus serum, and transfusion of blood. We have never been able to satisfy ourselves that bone-marrow does any good. In the published successful cases it has generally been given along with arsenic or other medicines, and the mere transference of a patient from an unfavourable environment to hospital might

be enough to determine a remission, especially in the case of a first attack. This explanation probably partly accounts for the successes which have been attributed to antistreptococcus serum, the other factor being a possible benefit from the serum itself, not from its antistreptococcus element. We have never seen a case in which benefit could be attributed to its use apart from these considerations, and we have certainly seen cases in which it did harm.

We have had cases which improved after a course of injections of normal horse serum. We have never seen anaphylactic symptoms in these cases, and if arsenic fails completely it is worth trying.

Transfusion of blood is a measure which is usually reserved for desperate cases. We have had several apparently brilliant successes, and many failures. Where there are urgent reasons for attempting to prolong the life of a hopeless case for a month or so, it is a measure which should be tried. It is much more satisfactory to do direct transfusion from a healthy and preferably young subject by the artery-to-vein method, than to use any of the indirect forms. During the last few years we have done many such transfusions. Practically all the patients improved for a longer or shorter time; in several cases a remission followed, though the subsequent history of the disease was not influenced.

In connection with the transfusion of blood for whatever purpose, it must be remembered that human blood falls into four groups. The serum of one person may agglutinate the corpuscles of another, and it may be assumed that the agglutinating serum will hæmolyse the corpuscles which it agglutinates. These relationships are shown in the following table:

		Serum of Group			
		I	II	III	IV
Corpuscles of Group	I.	0	+	+	+
	II.	0	0	+	+
	III.	0	+	0	+
	IV.	0	0	0	0

The point of importance is the effect of the recipient's serum on the corpuscles of the donor. It is clear that the possessor of Group I blood is a universal recipient, since his serum has no effect on the corpuscles of any group. A Group II patient can receive blood only from a Group II or IV donor. The possessor of Group IV blood is a universal donor, since no serum affects his corpuscles. When transfusion is proposed it is essential that the blood group of both patient and donor should be ascertained, unless a known Group IV donor be available. In urgent cases, or if sera of different groups are not available for the test, all that is strictly necessary is to determine that the serum of the recipient does not agglutinate the corpuscles of the donor. This can be settled in a few minutes at the bedside. (It is of course always desirable to perform a Wassermann of the donor's blood.) In spite of this precaution, destruction of the injected corpuscles may occur. We have known two such cases. In one, the injected corpuscles were broken down, as evidenced by hæmoglobinuria. The patient suffered from no disturbance, but was in no way benefited. The other case was remarkable. The day after injection he had rigors, high fever, and hæmoglobinuria, and became dangerously ill. This condition was recovered from in a few days. He then had a remission, and in a few weeks his corpuscles were just under 5,000,000. He has remained in good health for over two years!

In a few cases, which were all febrile, we have tried eusol intravenously. The temperature generally falls after the injections, but the course of the disease has not been affected.

As we have indicated earlier in this article, cases of pernicious anæmia seem to stand surgical operations surprisingly well, but the reasons for sanctioning any operation must always be clamant.

Splenectomy has often been performed as a treatment for pernicious anæmia; but, while the initial risk is great, the subsequent history of the cases which have been followed up is not such as to encourage us to adopt the procedure.

REFERENCES.—¹*Brit. Med. Jour.* 1913, May 24; ²*Johns Hop. Hosp. Bull.* 1913, Oct.

G. L. Gulland.
A. Goodall.

PERTUSSIS.—(See WHOOPING-COUGH.)

PHTHISIS.—(See PULMONARY TUBERCULOSIS.)

PILES.—(See HÆMORRHOIDS.)

PLACENTA PRÆVIA.—Placenta prævia is a very grave complication, and accounts annually for more maternal and foetal deaths than are revealed by statistics; when a patient is found to have it her friends had better be told she is in a position of great danger, and that the child will very likely not survive. Many sets of statistics have been published from large hospitals, and these show that the maternal mortality varies between 4 and 12 per cent, and the foetal between 50 and 85 per cent. Hospital figures are naturally more favourable than those of private practice, for the surroundings are more favourable and more skill is generally brought to bear on the cases, though the former must always include a certain number of patients transported into hospital in a moribund condition. Not many large sets of statistics from private practice are available; Fütth¹ collected 726 cases from the practice of doctors in his neighbourhood, with a maternal mortality of 20 per cent, and von Seuffert² collected the statistics in Bavaria from 1878 to 1907 and found a maternal mortality of 19 per cent. On the other hand, from the private practice of an expert obstetrician like De Lee,³ of Chicago, come 85 cases with only 3 deaths, giving the extremely low mortality of 3·5 per cent. Such figures, of course, include all types of cases treated, with varying degrees of skill, by all the methods in common use. In estimating the prognosis of a particular case of placenta prævia, many factors must be taken into account. The factors which chiefly influence the prognosis are the following: the variety of placenta prævia, the general condition of the patient (i.e., she may have lost only a little blood, or she may be anæmic from repeated hæmorrhages spread over a long period of time, or profoundly collapsed from a severe hæmorrhage), the parity of the patient, the degree of dilatation of the cervix, and the period of gestation. Last, but by no means least, comes the degree of skill with which the patient is likely to be treated; there is no doubt that the treatment of many cases of placenta prævia is difficult and demands expert midwifery.

The causes of maternal death may be: (1) Hæmorrhage from the placental site before delivery; (2) Shock or injury resulting from rough or too rapid delivery (i.e., extensive tears of the lower uterine segment and vagina as the result of dragging the foetus through an undilated cervix, or rupture of the uterus as the result of internal version; the lower uterine segment is softer and more vascular and is more liable to injury than in normal cases); (3) Post-partum hæmorrhage in a patient already depleted by ante-partum bleeding; (4) Puerperal septic infection, which is said to be responsible for 60 per cent of the mortality.

As regards the influence of the variety of placenta prævia upon the prognosis, the *complete* or *central* is very much more dangerous than the *incomplete* or *marginal*; the highest mortality occurs in the *central*, the lowest in the *marginal* variety. The reasons for this are that the area of placental separation is necessarily wide, that the membranes are out of reach, that the dilatation of the cervix is interfered with, and that operative manipulations are bound to disturb the placenta still more, and to cause more hæmorrhage. Complete placenta prævia in a primigravida with a closed cervix is one of the worst complications in midwifery. On the other hand, in the incomplete, and especially in the marginal, varieties, the membranes can be reached, the dilatation of the cervix is not much interfered with, and operative manipulations need not further disturb the placenta. If the patient is already in labour, and especially if the os uteri is well dilating and supple, the ease of treatment is enormously increased. Some of the most hopeless cases to deal with are those in which the patient is profoundly anæmic before treatment is begun; these include many neglected cases, a point which will be referred to again. The prognosis is more favourable in multiparæ than in primigravidæ, because of the more dilatable cervix and the greater ease of treatment in the former. The earlier the period of pregnancy, the smaller the foetus and the easier the treatment.

The bearing of different methods of treatment on the maternal mortality will be discussed below; but here certain general principles in the treatment of cases of placenta prævia cannot be too strongly emphasized. The strict observance of these principles has a very profound bearing on the prognosis of cases of placenta prævia. In every case of ante-partum hæmorrhage, however slight, the diagnosis of the variety (i.e., placenta prævia or 'accidental') must be made without delay. In a case of placenta prævia the cervix

is nearly always open enough to admit a finger, and the placenta can be felt. But if the cervix is closed, so important is it to make a correct diagnosis that the patient should be anæsthetized and the cervix dilated enough to admit the finger. The possibility that labour may thereby be induced is no objection, and is a risk that must be taken ; for if the case is one of placenta prævia, as it most probably is, labour will have to be induced in any case. The second great principle is that as soon as the diagnosis of placenta prævia is made, active treatment must be begun at once. The temporary cessation of hæmorrhage may give a false sense of security and an excuse for temporizing. This is a trap that must never be fallen into ; a profuse hæmorrhage may occur at any moment, even whilst a patient is being closely observed in a nursing home or hospital. There is one circumstance only when it is best for a while to postpone active treatment—when the patient is very collapsed from hæmorrhage and when the hæmorrhage has temporarily ceased ; under such circumstances active treatment may kill the patient from shock, and the period of freedom from hæmorrhage should be used for restoring her. Another important principle is the observance of careful asepsis in all examinations and operative manipulations ; still another is *slow delivery* of the fœtus, i.e., after version. The fœtus must not be dragged out through an undilated cervix, but delivery must be left to nature whenever possible.

There is no doubt that the observance of these principles of treatment—viz., early diagnosis, early treatment, slow delivery, and asepsis—would bring about a surprising fall in the maternal mortality of placenta prævia. The fœtal mortality, though it must of necessity always be high, is nevertheless capable of being greatly diminished. The two chief causes of fœtal death (apart from prematurity) are prolapse of the cord as the result of internal version, and cerebral hæmorrhage from too rapid delivery of the after-coming head after version. Prolapse of the cord can be largely avoided by substituting external version for bipolar version, followed of course by bringing down a leg for internal version ; and intracranial injury can be avoided by slow delivery of the after-coming head.

PROGNOSIS AS REGARDS THE METHOD OF TREATMENT.

There are three chief methods of treatment : (1) De Ribes' hydrostatic bag ; (2) Podalic version ; (3) Cæsarean section. Statistics are available for contrasting the maternal and fœtal mortalities of each of these methods ; but, in considering such statistics, it must be remembered that each method has its proper place and should not be employed indiscriminately for all varieties of cases.

1. De Ribes' Hydrostatic Bag.—The use of de Ribes' bag is eminently successful in suitable cases, such as a patulous os, early in or before labour, and in those cases in which it can be ascertained that the placenta does not cover the internal os completely. It is therefore applicable to a large majority of cases of placenta prævia.

The results of treatment by the bag vary considerably in different hands. In a group of cases undertaken under the ordinary conditions of life, it will be found that the mortality ranges between 6 and 8 per cent of all cases. If, on the other hand, figures are taken from special obstetrical hospitals, where there is a routine carefully followed and where the chief personally directs, the mortality is found to be as low as 2·18 per cent in Pinard's clinic and 2·1 per cent in the clinic of Krönig. The fœtal mortality varies widely, but ranges between 40 and 60 per cent ; this method is more favourable to the fœtus than version.

2. Podalic Version.—Turning the child is strongly recommended by certain authors as giving better results, and being more constantly effective, than the use of de Ribes' bag. It is the best method for general use ; it is suitable for all varieties of cases. The cervix must be sufficiently dilated to admit the thigh of the fœtus. Of the three methods of performing podalic version, external version, followed by bringing down the leg, is incomparably the best. Bipolar version is the next choice, and internal version, with its increased risks of sepsis and prolapse of the cord, is the last.

When the results are compared with those of the bag, it is seen that the *average* is nearly as good ; but the figures of skilled obstetricians do not come up to the best with de Ribes' bag. Thus the Rotunda statistics quoted by Tweedy⁴ show a mortality of 5·3 per cent in 110 cases during the years 1903 to 1910 ; but of the 41 delivered in hospital, there was only 1 death, or 2·5 per cent, which compares very favourably with the results of the use of the hydrostatic bag. There is no doubt that the fœtal mortality is higher by this

method—60 to 80 per cent ; but of course it depends to a certain extent upon the advancement of gestation and the time of commencement of treatment.

In comparing the three methods of treatment, it should be remembered that in the majority of cases the champion of podalic version as against de Ribes' bag, or vice versa, has become expert in that form of treatment ; there ought, however, to be a special field for each method—when its proper application will lead to a successful result.

3. Cæsarean Section.—Cæsarean section is becoming increasingly more prominent in the treatment of placenta prævia, but its employment should be restricted to a limited category of cases. It is especially indicated in cases of complete placenta prævia in primigravidae, where labour has not started and the cervix is intact. Such cases are of a very dangerous type for the mother, and are invariably fatal to the fœtus, if treated by ordinary methods ; but, given a capable operator and the proper environment, Cæsarean section need not be limited to the above type of case. Provided the patient is in good condition, the mortality of Cæsarean section for placenta prævia should be no higher than that for contracted pelvis in clean cases, viz., 2 to 3 per cent. The fœtal mortality should be zero, if the fœtus is alive at the time of operation. In cases where a woman is particularly anxious to have a live child, as for example in the case of a primigravida over forty, the fœtal indication becomes a very strong one. To get the best results, the operation must be undertaken early ; if the patient is already anæmic from loss of blood, or is possibly already infected, the results of Cæsarean section will not be good.

This is brought out in the statistics published of Eardley Holland⁵, from a collective investigation in 1921 ; the maternal mortality in 78 cases of complete placenta prævia was 14 per cent, and in 43 cases of the incomplete variety was 9 per cent ; in this series of cases the fœtal mortality was only 7 per cent.

In conclusion, the following figures may be taken as indicating the results of all cases of placenta prævia, irrespective of the treatment adopted : In 10,600 cases collected by Ellice MacDonald,⁶ the maternal mortality was 7·7 per cent and the fœtal mortality 55 per cent (the maternal mortality in the year 1877 was 23 per cent). Edgar⁷ records 40 cases with a maternal mortality of 7·5 per cent and a fœtal mortality of 32 per cent.

REFERENCES.—¹Quoted by De Lee ; ²Quoted by De Lee ; ³*Principles and Practice of Obstetrics*, 3rd Ed., 1918 ; ⁴*Jour. Obst. and Gynæcol. Brit. Emp.*, 1913, Aug. ; ⁵*Ibid.* Autumn-Winter number, 1921 ; ⁶*Surg. Gynecol. and Obst.*, 1911, June ; ⁷*Amer. Jour. Obst.*, 1911, July.

Eardley Holland.

PLAGUE.—Plague is one of the most deadly diseases known, and it carried off about a million people yearly in India during the height of the recent pandemic. The mortality varies in the different clinical varieties of the disease. The pneumonic form is extremely fatal, it being doubtful if recovery ever takes place. In Calcutta every case showing plague bacilli in the sputum died. This form is also extremely infectious by bacilli being disseminated during coughing, but not by ordinary breathing (Strong). The septicæmic form as seen clinically is also almost invariably fatal, numerous plague bacilli being found in the blood. On the other hand, in the much more common bubonic form, recovery takes place in a fair proportion of cases, the death-rate having been 30 per cent among 444 hospital cases examined by the India Plague Commission in Bombay, and it has been about the same in Calcutta.

The essential point in the prognosis is the presence or absence of plague bacilli in the blood-stream, in which they may be found by culture in the majority of cases of bubonic plague, as well as in the clinically septicæmic and pneumonic cases. Thus the India Plague Commission classified their 444 cases in accordance with the number of plague bacilli in $\frac{1}{4}$ c.c. of blood as follows :—

Bacilli in $\frac{1}{4}$ c.c. of blood	Cases	Per cent	Deaths	Died per cent	Recovered per cent
Nil - -	155	34·9	46	29·7	70·3
1 to 10 -	94	21·1	70	74·5	25·5
11 to 100 -	39	8·8	39	100·0	0·0
Over 100 -	156	35·1	153	100·0	0·0

Thus 70 per cent of the cases showing no bacilli in the blood recovered, but only 25·5 per cent of those showing from one to ten bacilli in $\frac{1}{4}$ c.c. of blood survived, while all of those with higher numbers died. In alternate cases plague serum was used, chiefly intravenously and in large doses up to 500 c.c., but the mortality was 73·7 per cent in the controls and 66·2 per cent in the serum cases: a difference which was considered to be too small to indicate any definite effect of the serum. Yersin's serum gave no decrease in the mortality, while antitoxic serum, prepared in the Lister Institute by means of nucleoproteid extracted from the plague bacilli by Rowland, gave a reduction of 20 per cent in the death-rate, which was confined to the cases showing not more than ten bacilli in $\frac{1}{4}$ c.c. of blood. In a mild form of plague at Havana the mortality in bubonic cases treated by Yersin's serum was only 22·2 per cent, but it failed in the one septicæmic case.

Clinically it is usually impossible to judge in the earlier stages what the prognosis will be. Later in its course the general condition of the patient may give some clue. Delirium, high and prolonged fever, and very rapid soft pulse are bad signs. A fall of temperature late in the disease, especially if sudden, is often only the prelude to fatal collapse. Cases showing primary vesicles at the seat of inoculation of the virus more frequently recover than others, in the writer's experience. Patients who live long enough for the buboes to suppurate, not infrequently recover.

No treatment is known to have any effect on the mortality of the disease, even the specific serum having failed in all but the mildest cases. It has been claimed that early incision of the bubo may lessen the toxic absorption, but this can hardly influence the common cases with numerous plague bacilli in the blood. Good nursing is more effective than drugs.

Leonard Rogers.

PLASTIC LINITIS.—(See STOMACH, SURGICAL AFFECTIONS OF.)

PLEURA, WOUNDS OF.—(See GUNSHOT WOUNDS.)

PLEURITIS.—The immediate prognosis of pleuritis is good; the remote prospects are not so satisfactory. An investigation of the examples of this disease admitted to St. Bartholomew's Hospital from 1899 to 1903 showed that the average length of treatment amounted to a little over three weeks in cases without effusion, and to rather less than five weeks in cases with effusion.

THE IMMEDIATE PROGNOSIS.—This varies with (1) *The nature of the organism*; (2) *The age of the patient*; (3) *The amount of fluid present*; and (4) *The associated conditions*.

1. Nature of the Organism.—Out of 47 cases of pleural effusion examined from a bacteriological standpoint at St. Bartholomew's Hospital, 40 were found to be sterile and therefore presumably *tuberculous*, 7 were associated with the *pneumococcus*, and 2 with the *streptococcus*. Other organisms which have been found in this condition are the *Bacillus typhosus*, *Pfeiffer's bacillus*, and the *gonococcus*. There is a greater tendency to the formation of pus in the case of the *pneumococcus* and *streptococcus*.

2. Age of the Patient.—In children and young adults the immediate dangers of pleuritis, whether with or without effusion, are small, and the mortality is probably less than 2 per cent.

3. Amount of Fluid Present.—The amount of fluid present when the case comes under observation has a definite bearing on the mortality. The danger of death from a small effusion is practically nil; but fluid which is present to such an extent that it reaches above the second rib causes positive pressure upon the heart and lungs, and so may cause death. Other causes of death in pleural effusion are thrombosis of the right heart and pericardial effusion. The presence of fine râles on the unaffected side is associated with a graver prognosis. Gee and Horder state that 651 cases of pleuritis between the years 1884 and 1893 gave a mortality of 10·3 per cent; whilst 783 cases between the years 1894 and 1903 gave a mortality of 1·4 per cent. Thus, 1434 cases were associated with a mortality of 4·1 per cent. The great difference between the mortality of the two series is attributed to improved methods of treatment, and especially to the earlier adoption of aspiration in the latter series.

4. Associated Conditions.—Pleuritis as a complication of existing disease is of graver significance than pleuritis occurring in a previously healthy person. Thus, pleuritis in

pulmonary tuberculosis denotes an extension of the original disease; whilst in chronic diseases such as Bright's disease it is of grave significance, and is not infrequently caused by the onset of tuberculosis. Extension of the inflammation to the pericardium tends to prolong the duration of the illness, but does not add greatly to the immediate mortality.

END-RESULTS.—The remote prospects of pleuritis, whether dry or with effusion, are chiefly concerned with the question whether the cause of the original inflammation is the tubercle bacillus or not. The proportion of cases of pleuritis which are due to the tubercle bacillus is considerable. Some French observers put the percentage as high as 75; few physicians put it lower than 30. Lord followed up 55 out of 82 patients he had observed, and found that 7 had died from pulmonary tuberculosis, 8 were suffering from this disease, and 40 were well. He further found that 25 per cent continued to complain of occasional pleuritic pains.

Fiedler found that of 92 cases of acute pleuritis with effusion, there had been 28 deaths from pulmonary tuberculosis at the end of two years, and that only 21 of the remaining patients appeared to be healthy. Barr found that in six years 22 patients out of 62 had died from pulmonary tuberculosis. Cabot had 117 deaths in five years out of 300 cases; whilst Hedges found that out of 130 cases, tuberculosis developed in 40 per cent in seven years. These figures are supported by two other lines of observation: (1) A positive tuberculin reaction is stated to be present in 75 per cent of cases of pleuritis with effusion; (2) At least 18 per cent of the cases of pulmonary tuberculosis admitted to the chest hospitals in London have a history of pleuritis two or more years before.

The practical deduction is that a large number of cases of pleuritis can be demonstrated to have a tuberculous origin, and that an even greater proportion are due to this cause. In view of the great frequency, subsequently, of pulmonary tuberculosis in these cases, it is not too much to say that every primary case of pleuritis, whether with or without effusion, should be regarded as tuberculous, unless the contrary can be proved. If this were done, and all such cases were treated for some time on sanatorium lines, together with tuberculin, a great step would be taken in diminishing the incidence of pulmonary tuberculosis. My own experience in this direction is most satisfactory; and I am tempted to express the opinion that primary pleuritis, when regarded as a comparatively trivial affection, is associated in later years with a high mortality from pulmonary tuberculosis; whereas, when it is adequately treated from the commencement as being tuberculous, the after-results are almost as good as the immediate ones.

Arthur Latham.

PNEUMOCOCCAL MENINGITIS.—(See MENINGITIS.)

PNEUMONIA.—The mortality from pneumonia when taken over a considerable number of years amounts to about 1 in 5, or 20 per cent. Thus, Wells collected 465,400 cases with a mortality of 94,826, or 20.4 per cent; Osler and McCrae collected 43,555 cases with a mortality of 21 per cent; in the 7868 cases which occurred in the London general hospitals during ten years, there was a mortality of 21 per cent; in 1065 cases of the Collective Investigation Committee of London, the mortality was 1 in 5.5. Even when the causes which are associated with a high mortality in this disease—such as intemperance, mental and physical deformities, infectious cases, old age—are allowed for, the mortality appears to be 1 in 8.

The character of the epidemic, that is to say, the virulence of the causal organism, affects the mortality, as it may affect the character of the complications. Thus, the 673 cases observed in the Middlesex Hospital from 1880 to 1889 showed a mortality of 17 per cent; but when the different years were compared, the mortality varied from 12 to 24 per cent. This explains why such widely different results are given when the effects of different treatments are compared over a comparatively small number of cases. For example, some authors claim a mortality of as little as 2 per cent, whilst others confess to a mortality of over 30 per cent. As bearing on this point, I would mention that I have known five people die from pneumonia in one house within a fortnight. Tyson quotes an epidemic in a ship's crew, in which 298 cases out of 720 ended fatally.

In a similar way the character of the epidemic may affect the complications: thus, in three months I saw pneumonia followed by abscess of the lung in no less than seven cases.

It has been shown by Dr. Rufus Cole and others that in pneumonia we have at least *four types of pneumococci*. *Types I* and *II* are specific organisms in the same category as typhoid bacilli; they appear to account for 60 to 65 per cent of cases. *Type III* organisms are widely distributed in healthy mouths, and account for 10 to 15 per cent of cases. Those of *Type IV* are the most commonly found varieties in healthy mouths, and appear to account for about 25 per cent of cases, the infection here being probably auto-genous. The different types have a different virulence, and consequently the prognosis in a given case will be affected by the type of organism present. In the prognosis of a case of pneumonia, therefore, we require to know the type of pneumococcus present, and we may hope that as observations on this point accumulate, we shall be in a much better position to estimate the probable course of a given case. For example, it has been found possible to manufacture immune horse serum for *Type I*, with the result that in a limited number (78) of cases treated in the Hospital of the Rockefeller Institute the mortality was 8 per cent, as compared with 25 per cent in similar cases untreated by the serum.

As regards age, it would appear that pneumonia is especially fatal to children under two years of age, and to old people. With regard to children, Gossage, in observing 986 cases under ten years of age, found a mortality of 13·8 per cent. Of these, cases under two years of age gave a mortality of 26·4 per cent, whilst above this age it was only 6·2 per cent. These figures are borne out by most observers; and in most epidemics of pneumonia, children of from five to ten years of age have the disease in a mild form, which often aborts on the fourth day. I have seen recovery in one case at the age of fourteen from a typical attack where it was stated that the child had had fifteen or more similar attacks.

Various factors influence the prognosis. The mortality in hospital cases is greater than in private practice: in drunkards it is probably at least double. Although women are less frequently attacked than men, it is stated that their mortality is greater. Again, the mortality is greater in negroes than in white people, in debilitated persons than in those previously robust, and is much increased when there is associated disease such as arteriosclerosis, severe cardiac affections, chronic nephritis, or diabetes.

With regard to the position and extent, it is stated that right-sided lesions are more fatal than those on the left, and it is generally held that apical lesions are more dangerous than basal ones, more especially in attacks during old age. The extent of lung involved affects the result, but appears to exert rather less influence than might be expected, as may be seen in the following tables of Osler and McCrae:—

MORTALITY AS AFFECTED BY EXTENT OF LUNG INVOLVED.

Fatal Cases					Non-fatal Cases				
1 lobe involved in	21	per cent			1 lobe involved in	40	per cent		
2 lobes	„	„	38	„	2 lobes	„	„	33	„
3	„	„	31	„	3	„	„	20	„
4	„	„	9	„	4	„	„	1	„

The effect of complications has no great bearing on the total mortality from pneumonia, as they are, comparatively speaking, uncommon. Their effect on the cases in which they occur is greater. Thus, of the 7868 cases observed in the London hospitals, there were only 290 cases of empyema, or 3·7 per cent, of which 88 were fatal, or about 30 per cent; 125 cases of pleural effusion, or 1·6 per cent, of which 13 were fatal, or about 10 per cent. Pericarditis only occurred in 1 per cent of these cases, but of the fatalities 10 per cent were associated with this complication. In children, convulsions in the early stages have little significance, but in the later stages they are associated with a higher death-rate. Herpes is held to be a favourable sign; thus, Gisseler noted the presence of herpes in 182 out of 421 cases, and found the mortality less when this complication occurred.

The degree of toxæmia and the reaction to it are really the most important factors in estimating the outlook in a particular case of pneumonia. For practical purposes these must usually be estimated from a consideration of the temperature, pulse, and

PNEUMONIA

respiration. The following tables of Prebles on the relation of the temperature-, pulse-, and respiration-rate to the mortality, are therefore of interest.

It will be seen that when the temperature is low—i.e., below 100°—or above 105° the mortality is greater than the average; that when the pulse is above 130 the mortality is more than doubled; and that when the respirations are more than 50 the mortality is 50 per cent or more.

TEMPERATURE AND MORTALITY.

Temperature	Cases	Deaths	Percentage
Under 100°	17	6	35.2
102°	220	52	23.1
103°	302	83	27.4
104°	408	109	26.7
105°	386	99	26.0
106°	148	45	30.5
Over 106°	34	23	68.0

PULSE-RATE AND MORTALITY.

Pulse	Cases	Deaths	Percentage
Under 100	57	2	3.5
110	123	7	5.7
120	142	18	12.6
130	288	62	21.5
140	143	68	47.0
150	125	74	59.0
Over 150	83	64	77.0

RESPIRATION-RATE AND MORTALITY.

Respiration	Cases	Deaths	Percentage
Under 30	77	6	7.7
40	247	36	14.0
50	384	116	30.2
60	123	62	50.4
70	98	61	62.2
Over 70	23	14	65.6

If the infection causes little response, as is often the case in old people, and the temperature remains low, the outlook is grave; if the infection is severe and causes marked toxæmia, as shown by temperature, pulse, and respiration, the mortality is greatly increased; but when the infection is met with an adequate response, and the temperature is below 105°, the pulse-rate below 130, and the respiration-rate below 40, the mortality is about 1 in 5.

The action of the heart, and especially of the right ventricle, is always significant. When the right heart becomes distended, and the pulse in addition to being rapid becomes irregular, the outlook is grave. When auricular fibrillation occurs during the attack, even though the crisis may appear to have been safely passed, the case always ends fatally.

Although the outlook may appear hopeless, treatment—especially with cardiac and respiratory stimulants such as alcohol, digitalis, and strychnine—should be continued and pushed until a definite effect is obtained, for in no other disease are there so many recoveries from an apparently inevitable death.

Different forms of treatment, such as the use of vaccines, the systematic employment of digitalis, or the use of various other methods, have not been shown to have any

markedly different results in a sufficiently large number of cases. In a limited number of cases of *Type I*, the use of immune horse serum, as mentioned above, appeared to have a marked effect upon the mortality. Patients moved to hospital on the first day of the disease appear to have a better prognosis than those moved on the third or fourth. This is probably explained by the effect of movement in inducing excessive auto-inoculations, as in other cases of bacterial infection, and emphasizes the necessity of limiting the movements and examination of the patient as much as possible during the acute stage of the disease.

Those who suffer from an attack of pneumonia not infrequently have another attack later in life. Some authors put this tendency to a second attack at as high a figure as 50 per cent.

Arthur Latham.

PNEUMOTHORAX.—The prognosis differs greatly according to the cause and to the condition of the patient in whom it occurs.

In the spontaneous form, which is chiefly dependent on the tearing of the lung by the rupture of an adhesion, infective agencies are absent, and consequently one of the most serious complications is absent also. Further, in this form, effusion is rarely found. In 58 cases studied by Fussell and Rissman, effusion only occurred in one instance. Adams, however, reported a case in which effusion lasted for four years. The outlook in this form of pneumothorax is good, and recovery is the rule, provided the general condition of the patient is good. It may occur in a week, or it may be delayed for several months. In Fussell and Rissman's series only one death resulted. On the other hand, when pneumothorax is a complication of advanced emphysema, with severe overtaxing of the heart, it is a grave complication and usually fatal.

In the traumatic form, the prognosis depends chiefly on the character of the wound, and more especially on the question whether septic complications occur. In the absence of sepsis the outlook is good. Cases which occur as the result of thoracentesis usually do well.

Cases in which pneumothorax is due to the perforation of the lung by an empyema, often do well after the necessary surgical measures have been taken.

Cases associated with gangrene, rupture of septic infarcts, or bronchiectasis are, practically speaking, always fatal.

Pneumothorax occurring in a case of pulmonary tuberculosis is usually attended with a grave outlook, as it is most commonly met with when the disease is advanced and both lungs are extensively affected. Samuel West, as the result of observations on 101 cases, gives the mortality as being about 70 per cent; Saussier recorded a fatal result in 131 out of 147 cases, that is to say, a percentage of 90. Of 58 cases of pneumothorax collected from the post-mortem records of the Brompton Hospital, the greatest duration of life was twelve years, the least duration ten minutes. On the other hand, cases with a much longer duration are on record. Dr. Williams reported a case, occurring in his private practice, in which life was prolonged for twenty-one years.

It would appear that recovery may take place in from 10 to 25 per cent of cases; and further, that in a small number of instances the occurrence of pneumothorax may be beneficial to the patient, leading to arrest of the disease, in the same way as the artificial compression of the lung by nitrogen is sometimes followed by great improvement or complete recovery. I have personally seen recovery after pneumothorax with arrest of the tuberculous disease in two cases.

The prognosis in pneumothorax is therefore bad, when viewed as a whole. Whether it is immediately associated with fatal results depends on the extent of the primary disease and the general condition of the patient, that is, his capacity to withstand the great shock which is caused by the production of this complication. The practice of removing the air from the distended pleura at an early stage has certainly decreased the immediate mortality. If the pneumothorax is sharply limited by adhesions, and small in extent, it may be without effect on the duration of life, and even escape notice at the time of its production; but in the case of a general pneumothorax the chief consideration at the time it is produced is the effect of the immediate shock.

If the stage of shock is survived, the chief considerations in estimating prognosis are the general condition of the patient, the extent of disease in the other lung, and the

Treatment.—So far, the results are not very decisive. The cases are wholly unsuitable for suprapubic enucleations; 4 out of 11 such patients at St. Thomas's Hospital died within a few weeks.

Young's perineal route gives better results. His radical operation, with wide removal, has apparently cured 2 patients out of 6, these being well four and six years respectively; another lived three years. Out of 19 patients treated by his ordinary method, as used for simple cases, all but 4 obtained some relief; 2 lived in comfort for two and three years respectively, and 2 others were apparently cured, 1 being well so long as six years afterwards.

In 39 cases, catheter life was instituted, with no operation. It often became very difficult, and out of 23 cases followed, only 3 lived two years.

Judd³ found evidence that 75 out of 177 cases arose in a hypertrophied prostate. Of 82 cases followed up after operation, 24 died within six months, and 5 others after an unknown interval; 14 were well three years after operation (1 nine years after), 16 two years, and 20 one year after. Apparently 3 were living, with recurrence.

REFERENCES.—¹Young, *Ann. of Surg.* 1909, 1, 1144; ²Bumpus, *Surg. Gynecol. and Obst.* xxxii, 1921, 31; ³Judd, *Internat. Jour. Surg.* 1915, xxviii, 17. A. Rendle Short.

PROSTATE, HYPERTROPHY OF.—We shall here speak only of cases of simple overgrowth of the prostate, reserving malignant affection of the gland for a separate article.

PROGNOSIS APART FROM OPERATION.—It must be borne in mind that enlargement of the prostate is a progressive disease. Acute exacerbations due to inflammation may subside under treatment, but we have no means of checking the steady growth. When symptoms have once appeared, therefore, there is a tendency for them to get worse instead of better. In a fair proportion of cases seen, however, a fortunate man may live for years with or without the regular use of a catheter, any advance in the size of the prostate being very slow indeed. Much depends on the person's age; in an old man, senile decay may intervene before the prostatic trouble proves fatal; whereas, in a patient in the fifties, and in good general health, difficulties with micturition and uræmia are likely to shorten life very considerably. The most favourable cases are those in which, owing to some definite cause, such as lack of opportunity to pass water on a long journey, an attack of acute retention is precipitated. After a few days of rest and catheterism, voluntary power of micturition may be regained for years. Much more commonly the retention is permanent.

Ordinarily, there are five successive stages: (1) Difficulty in micturition, with straining; (2) Frequency of micturition, seriously interfering with sleep; (3) Acute or chronic retention of urine, necessitating the occasional or regular use of the catheter; (4) Chronic cystitis; the discomfort and frequency now get much worse; (5) Septic infection of the kidneys, leading to uræmia.

The total course varies so much that one can only form a prognosis by judging each patient's prospects separately. Unintelligent old men often present themselves, obviously but a few weeks before the inevitable fatal termination, and give a history of bladder troubles only within the past month or so. On the other hand, a patient may have symptoms of an enlarged prostate for eight or ten years, but this is unusually favourable.

Many patients pass into an extremely miserable condition. Their morale may become unhinged, and offences against decency may ruin their reputation. Later, great frequency of micturition, pain, hæmaturia, loss of sleep, and calculus formation due to ammoniacal fermentation of the urine, wear out their strength. When marked cystitis and frequency are present, the patient has, in the majority of cases, not many months to live, apart from surgical intervention. Loss of appetite, thirst, sweating, drowsiness, twitchings or convulsions, emaciation, urinous breath, tendency to catheter fever, and polyuria with urea output below 15 grm. a day, show that uræmia has already begun, and death is not far off. Retention is a sign of some gravity unless most carefully treated; it leads frequently to cystitis; and if all the urine is drawn off at once from a patient with chronic retention, fatal suppression of urine is not at all uncommon, owing to the dilated ureters allowing a sudden fall of pressure in the renal pelves.

The main factor in the prognosis is the efficiency or bankruptcy of the kidneys. There are various chemical means of estimating this, as well as the clinical signs just

mentioned. The best are the quantitative estimation of the blood urea (normal is 20 mgrm. per 100 c.c.; above 40 is a sign of renal failure); the urea concentration test determined by giving 15 gm. by the mouth; and the phenolsulphonephthalein test. Fortunately, good drainage of the bladder will often restore a damaged kidney to some degree of efficiency.

In estimating the prognosis apart from operation, therefore, one has to take into account: (1) *The patient's age*, bearing in mind that the younger the man is, the more will his natural expectation of life be shortened; (2) *The apparent rate of progress*; (3) *His intelligence and skill in using a catheter, and keeping it clean*; and (4) *The question of cystitis, or of signs of uræmia*. The question of *malignancy* really enters into the prognosis also, because it is impossible to make a certain diagnosis at first, and one case in five of prostatic enlargement is cancerous. It is all but certain that cancer may supervene on a simple hypertrophy.

CATHETER LIFE—When the power of micturition has been more or less completely lost, the patient, apart from operation, must necessarily enter upon catheter life. Either the doctor or a trained attendant may pass the catheter, or he may pass it himself. In the latter case, it is certain that more or less cystitis will supervene, and in the great majority of men this will kill the patient, or drive him perforce to operation, within six months. In a considerable minority, however, the bladder appears to be unusually tolerant of infection, and he may go on for years without serious impairment of the health. Eventually hæmorrhage, or calculus formation, may necessitate removal of the prostate.

Another method of treatment, when the patient can or must be kept in bed, is by means of the indwelling catheter. Briggs reports twenty-two cases in which this was used, and concludes that "end-results show that one should hesitate before advising the catheter for a condition that demands the knife".

PROGNOSIS AS REGARDS OPERATION.—Of operations for enlarged prostate, we may mention *suprapubic enucleation*, *perineal prostatectomy*, *Bottini's operation*, and the *bar-punch operation*.

Suprapubic Prostatectomy.—Largely owing to the teaching of Freyer, this is the customary operation in England, the perineal route being the favourite in some American clinics.

The mortality-rate is bound to vary much, according to the condition of the patient at the time the operation is undertaken, and there is a great difference between the figures which could be quoted. Freyer, in 1912, reported a series of 1000 cases with only 55 deaths, but at the same meeting Hey Groves stated that the death-rate in English hospitals, for the year 1907, was 40 per cent! This latter figure is undoubtedly far too high at the present day, because hospital surgeons are not now so ready to operate in one stage upon patients whose kidneys are already affected, and general practitioners are beginning to send in cases that are not yet *in extremis*. The English hospital statistics up to 1912 showed a death-rate of about 20 per cent. At two Bristol hospitals, during the years 1906 to 1912, it was decidedly higher than this, early cases being few. Out of 68 patients, 24 died, a mortality of 35 per cent. At "one of the largest hospitals", according to Wade, out of 164 operation cases in ten years 54 died, that is, 35 per cent. At St. Thomas's Hospital, 1906 to 1910, of 69 cases, 14 died, a mortality of 20·3 per cent; and at four other London hospitals during the same period, 16 died out of 76. It must be remembered that many of the patients who succumbed in hospital were already desperately ill; and the genuinely favourable cases were not very well represented, because many surgeons did not recommend operation to patients who could be treated by catheterization.

During the past eight years there has been a great improvement in hospital statistics. At the Bristol Royal Infirmary the present death-rate is well under 10 per cent.

The increased safety is due to better selection of cases, and to the use of a two-stage operation when necessary.

In the hands of surgeons whose material includes a large proportion of cases derived from private practice, the mortality is lower still. Freyer, as already mentioned, lost 55 out of 1000 cases. Thomson Walker, in a series of over 100, had a death-rate of 5 per cent. Yet both these surgeons claim to have accepted bad cases; Thomson Walker declares that he exercised practically no selection, except in cases where any sort of

operation would obviously be foolhardy, and Freyer remarks that many of his patients were desperately ill, usually more or less dependent on the catheter, few were free from cystitis, 181 had vesical calculus (of these, 8·5 per cent died), and 62 were octogenarians.

We may conclude, therefore, that the mortality of suprapubic prostatectomy, in capable hands, is well below 5 per cent, in patients with fairly sound kidneys.

The causes of death are uræmia (24 out of Freyer's 55 fatalities), shock or heart failure, and chest complications.

The end-results of suprapubic prostatectomy are no doubt remarkably good. Freyer claims that every case of his surviving the operation has a perfect result, except one patient with atony of the bladder; he has never seen retention, incontinence, fistula, or loss of sex-power. He does not, however, give data showing how many patients were seen or heard from at any considerable period after the operation. He claims, and all surgeons will corroborate the statement, that atony of the bladder, even when it appears to have already come on, recovers wonderfully after removal of the prostate.

Thomson Walker has carefully studied 112 cases of his own, followed for at least eighteen months. The results were as follows: Incontinence of urine, 0; atony of bladder, 2; loss of sexual functions, 11; cystitis, occasionally persists; development of vesical calculus, 6; suprapubic fistula, 2; suprapubic hernia, 2; recurrent hæmorrhage, 1. All the rest were restored to perfect health; and it must be remarked that in the atony cases, in most of those with loss of sexual functions, and in three out of the six cases of stone, the trouble was but a persistence or recurrence of the pre-operative condition. One of the fistula patients was cured by a second operation. It will be observed that, omitting the patients with impotence, cystitis, or calculus, 105 out of 112 were cured.

An unusual sequel, very difficult to deal with when it does occur, is stricturing at the internal meatus by union of flaps of bladder mucosa in the form of a septum over the cavity from which the prostate has been enucleated. It is more likely to happen when the prostate is small, and may probably be prevented by stitching the flaps out of the way, using a Thomson Walker retractor to obtain a view.

Of 26 patients at St. Thomas's Hospital and followed up, 20 did excellently, 2 developed a stone, 3 had incomplete control (two of these were possibly cancerous), and 1 had a suprapubic fistula.

Of 32 cases operated on in two Bristol hospitals, 24 were perfectly well, and 2 were only troubled by some degree of frequency. Of the others, 2 patients developed a stone, and in 1 of these the suprapubic opening failed to close; 2 had some incontinence; and in 3 patients there was little or no relief, straining and difficulty persisting; one or two of these were possibly cancerous. All these were followed at least a year.

The sexual functions were completely lost in only 12·5 per cent of Thomson Walker's cases; many of these were aged men, and in some there was impotence or loss of desire before operation. Occasionally a troublesome degree of stricture of the commencement of the urethra may follow.

Perineal Prostatectomy.—This operation is performed in several different ways, some of which do not conserve the membranous urethra as well as others; we have material for studying the end-results of Young's method, which is probably the best. The special points are the use of his tractor, and the preservation of the ejaculatory ducts and mucous membrane of the base of the bladder.

MORTALITY OF PROSTATECTOMY.

Operation and Reporter	Cases	Died	Lost per cent.
<i>Suprapubic</i> —Freyer - - - -	1000	55	5·5
Thomson Walker - - - -	over 100	—	5·0
<i>Perineal</i> —Young - - - -	450	17	3·8
Legueu - - - -	1026	—	8·0

The mortality-rate in 450 cases was 17, that is, 3·8 per cent; there were 128 consecutive operations without a fatality. Some of the deaths might have been prevented by more careful washing out of the bladder beforehand. Legueu, in a series of 1026 cases obtained

PROSTATE, HYPERTROPHY OF

by combining a number of published figures, says that the death-rate of perineal prostatectomy is 8 per cent.

The patients get about sooner than after the suprapubic operation, more than half going home in a month.

END-RESULTS OF PROSTATECTOMY.

Operation and Reporter		Cases followed	Cured	Per cent	Hæmorrhage	Some incontinence	Atony or obstruction	Calculus developed	Fistula	Suprapubic hernia
Suprapubic	Thomson Walker -	112	99	80	1	0	2	6	2	2
	St. Thomas's Hospital -	26	20	77	0	3	0	2	1	0
	Two Bristol hospitals -	32	24	75	0	2	3	2	1	0
Perineal—Young		403	361?	89	0	3	12	?	27*	0

* Open 3 months after operation.

The end-results were followed up by Young in 403 cases—for at least six months in all but 26. Of these, 79 died of various intercurrent affections, and 324 survived until the report.

All but 12 can hold water for three hours or more by day ; about a quarter can go all night, but most have to rise once or twice. Although 70 per cent required the catheter before operation, only 4 patients were still wholly dependent on it, and 8 more had some partial obstruction. In all the rest there was a perfect result with regard to micturition. None had incontinence night and day ; 3 only by day. All the 79 patients who died did well as far as urinary troubles were concerned, except 2 who are included in this summary. The principal drawback of the perineal route is persistence of the fistula ; in 27 of Young's cases it was open three months after operation, but it is not stated in how many of these it remained open permanently. Some other advocates of the perineal operation report 3 to 6 per cent of cases of persistent fistula, and 2 to 4 per cent of cases of recto-vesical or recto-urethral fistula.

SEXUAL POWER (ERECTIONS) LOST AFTER PROSTATECTOMY.

Operation and Reporter	Cases	Lost per cent
Suprapubic—Thomson Walker -	—	12·5
Perineal—Young -	133	25·0

The sex-functions were retained in 59 per cent of 133 cases in which they were normal before operation, and 75 per cent still obtained erections.

In Young's hands the perineal operation certainly gives better results, both immediately and remotely, than suprapubic enucleation, but it is doubtful if this would be the universal experience. It is better perhaps for small hard prostates, but Freyer's method will still hold a place for large glands.

An excellent table of comparative end-results has recently been published by Martin, relating to 110 cases of prostatectomy, 55 removed by the suprapubic and 55 by the perineal routes. The results are greatly in favour of the former method. The information was obtained by correspondence with the family physician.

Closure of Wound.—

Within 4 weeks—suprapubic, 61 per cent ; perineal, 42 per cent
" 12 months— " 100 " ; " 84 "

Stricture following.—

Suprapubic, 3 out of 46 = 6·5 per cent ; perineal, 10 out of 43 = 23·2 per cent

Frequency.—

					Suprapubic	Perineal
<i>By Day.</i>						
Normal	-	-	-	-	30	24
2 hours	-	-	-	-	5	10
1 hour	-	-	-	-	1	2
$\frac{1}{2}$ hour	-	-	-	-	1	0
<i>By night.</i>						
Do not rise	-	-	-	-	13	1
Once or twice	-	-	-	-	16	16
Three times or more	-	-	-	-	6	21

Thus, in 73 cases in which information is available:—

			Suprapubic		Perineal.	
			Day Per cent	Night Per cent	Day Per cent	Night Per cent
Result	good	-	81.0	82.8	66.6	44.7
„	fair	-	13.5	5.7	27.7	23.7
„	poor	-	5.4	11.5	5.5	31.5

Control			Suprapubic		Perineal	
Full	-	-	37 = 80.5	%	32 = 64	%
Partial	-	-	7 = 15.2	%	11 = 22	%
Incontinent	-	-	2 = 4.2	%	7 = 14	%

Cystitis			Suprapubic.		Perineal.	
Present	-	-	16 = 35	%	15 = 31	%
Absent	-	-	30 = 65	%	33 = 69	%

Pain			Suprapubic		Perineal	
Present	-	-	10 = 21	%	8 = 16	%
Absent	-	-	38 = 79	%	41 = 84	%

Sex Power			Suprapubic		Perineal	
No change	-	-	21 = 63.6	%	16 = 48.5	%
Less	-	-	9 = 27.0	%	16 = 48.5	%
Better	-	-	3 = 9.1	%	1 = 3.0	%

Bottini's Operation and Young's Bar-punch Operation.—These are indicated in cases where the prostate is not enlarged, but a median bar obstructs the urethra. Young reports 67 cases treated by his punch without a death; 4 of these were failures, and 63 gave good or perfect results.

REFERENCES.—Freyer, *Brit. Med. Jour.* 1912, ii, 868; Thomson Walker, *Clin. Jour.* 1912, xl, 261; Page, *St. Thomas's Hosp. Rep.* 1910, 135; Young, *Surg. Gynecol and Obst.* 1911, xiii, 269; Young, *Keen's Surgery*, vol. vi, 670; Simons, *Interstate Med. Jour.* 1918, xxv, 469; Martin, *Jour. Amer. Med. Assoc.* 1918, lxx, 1287.

A. Rendle Short.

PROSTATIC CALCULI.—These are not very often met with, and, of course, require removal. Incontinence of urine is apt to follow the operation. In a case under Mr. Morton's care, seen by the writer, they returned again and again after repeated removals.

A. Rendle Short.

PSOAS ABSCESS.—We shall confine our remarks under this heading to tuberculous abscesses arising, in the great majority of cases, from caries of the spine.

The material available for coming to a sound conclusion as to the prognosis of this disease is very scanty. The condition is rather uncommon, so that no one surgeon is able to present a record of a long series of personally-observed cases. We shall here base our study upon the not very recent figures of Lovett, relating to 54 patients under fourteen years of age treated at the Boston Children's Hospital, and upon the notes of 56 cases treated at the Royal Infirmary and General Hospital, Bristol.

The great majority of the cases were, of course, operated on. Nevertheless, recovery apart from operation is not impossible, given rest and favourable conditions. Of 5 children not operated on at Boston, 2 were healed; and 2 probable psoas abscess cases at one of the Bristol hospitals, treated by rest, have made an excellent recovery. Such a happy issue must be regarded as exceptional; usually the abscess will burst and become infected with the organisms of suppuration, which of course makes the outlook much less hopeful.

At the Boston Children's Hospital, the routine treatment was opening and draining by a tube or gauze. More modern practice would prefer, in favourable cases, to evacuate the pus and sew up again; and the results might have been better if this course had been adopted. Of the 49 patients operated on, none died within a month; 6 were lost sight of. Of the 43 followed up for periods from one to ten years, 17 died, and 26 were still alive. The fatal result usually occurred more than a year after the operation. Of the 26 survivors, 12 were cured, 10 much improved, but still suffering from sinuses or pain in the back, and 4 were little or no better. These results, and those of the Bristol cases, are set out in the table subjoined.

RESULTS OF OPERATION FOR PSOAS ABSCESS.

Hospital	Cases operated on	Died within a month	Cases followed	Cured or nearly cured	Much improved	Un-changed	Died since
Boston Children's Hospital -	49	0	43	12	10	4	17
Two hospitals, Bristol -	54	2	37*	17	3	4	13
Total	103	2	80	29 (or 36 per cent)	13 (or 16 per cent)	8 (or 10 per cent)	30 (or 37.5 per cent)

* 11 cases under sixteen years of age, 26 over sixteen.

The Bristol cases were followed for periods from eighteen months to twelve years (very few under two years). The infected cases were usually drained, and the purely tuberculous abscesses evacuated, scraped, and closed. The results are about the same as the American ones. It will be seen, combining the figures, that the immediate mortality is low, about 2 per cent; that, of 80 cases, about a third are cured or show only a trifling sinus, a third have died since, and the remaining third are either improved or *in statu quo*, the wounds remaining open and the back still painful. Contrary to expectation, the results in patients over sixteen were very decidedly better than in children; of the former group, 13 out of 23 did well. The figures are, however, too small to be reliable on this point.

In fatal cases, death usually takes place after many months or years of invalidism; albuminoid disease, chronic suppuration and exhaustion, and tuberculous meningitis figuring largely in the final issue. The average time in 11 Bristol cases was between two and three years.

With reference to the prognosis in individual cases, the outlook is much graver if secondary infection with cocci takes place. Lovett shows that fever is of bad omen; thus, of 10 febrile cases, 3 lived, 7 died, mortality 70 per cent; of 30 afebrile cases, 20 lived, 10 died, mortality 33 per cent.

The development of a fæcal fistula is extremely grave.

With reference to the mode of operation, Lovett gives evidence which tells against the practice of opening both in the groin and the lumbar region; but it must be borne

in mind that the double incision was probably adopted for the larger abscesses. His table is as follows :—

RESULTS OF DIFFERENT OPERATIONS (LOVETT).

Operation	Cases followed	Living	Died
Iliac opening - - -	11	8	3
Lumbar opening - - -	13	9	4
Iliac and lumbar opening - -	13	4	9
Gluteal opening - - -	5	4	1

He believes that a better result is obtained if the patient is kept sitting or standing after operation, to promote drainage.

We may conclude, therefore, that of cases of psoas abscess, about a third recover more or less completely, a third die, and, of the remainder, some improve, and some go on for years in a wretched state. The average duration of life in fatal cases is two to three years. According to the figures given here (too small to generalize from), it would appear that adults do better than children; this is doubtful.

REFERENCE.—Lovett, *Boston Med. and Surg. Jour.* 1901, cxliv, 463.

A. Rendle Short.

PSORIASIS.—We have to consider (1) *The immediate prognosis*; and (2) *The liability to recurrence*.

1. Immediate Prognosis.—This will depend upon whether the patient can or cannot give himself up entirely to treatment. The ambulatory treatment of an extensive psoriasis is most unsatisfactory, and the sufferer may not be free from the eruption for years. In a long-standing case, the patient may, perhaps not unwisely, object to lying up for the removal of an eruption which does not trouble him seriously, and which he knows by experience will certainly recur. If the sufferer from psoriasis can give himself up to treatment, and will submit to chrysarobin, the eruption can in many cases be removed in three or four weeks. A longer time will usually be necessary if the scalp is badly involved, as chrysarobin cannot be used in this region. No other remedy is so rapid in its action; if the drug be objected to—and it has many drawbacks—a longer time must be allowed for treatment. The drugs next in efficiency are the tars, oil of cade, pyrogallol, and the derivative of the latter, eugallol.

An extended experience has shown the value of the x rays in the treatment of psoriasis when the areas are limited. The periods of intermission are certainly lengthened in many instances, and the patient is enabled to continue at work without the constant application of ointments. A warning must, however, be given that repeated application of moderate doses of x rays may leave permanent telangiectases in the treated areas.

As regards the value of internal treatment, the writer cannot say that he has been greatly impressed by any measure. Arsenic, given either by the mouth or, probably more effectively, by injection, is certainly of some value. Hutchinson stated that he had cured cases by arsenic alone; and the writer knows cases in which its timely use, together with simple alkaline baths, cuts short an attack.

2. Liability to Recurrence.—It is impossible to give a hopeful prognosis as regards recurrences in psoriasis. In some cases, the patient may be free for several months, or a year or so; in others, the intervals last for a few weeks only. Recurrence, sooner or later, is the rule, and nothing that we know at present can prevent it. The patients are often in the best of health, and in some instances they only lose their eruption when they are out of condition. Relapses are less common where the scalp can be kept free from disease, and the eruption is less liable to recur if completely removed by treatment; but it is at present impossible to speak more favourably.

J. H. Sequeira.

PUERPERAL INSANITY.—(See MENTAL DISEASES.)

PUERPERAL SEPSIS.—In puerperal infections, the clinical manifestations are of immense importance in coming to a decision as to the prognosis in individual cases. With regard to the results of treatment, so much variety exists in the classification of cases, that it is difficult to compare the results of different reporters. Thus, while for some American and English authors the mortality is lowered by half when vaccines are used, other writers, especially Continental authorities, absolutely ignoring vaccine therapy, can show very similar results. The truth would appear to be that there is an average mortality figure for each group of puerperal sepsis, and a lower figure where appropriate treatment is applied in each case.

Early diagnosis and prompt treatment make a great difference to the prognosis; if treatment by sera and vaccines is begun in the earliest stages of an acute infection, the mortality is much lower; in every case of sudden rise of temperature and pulse at the commencement of the puerperium, no time should be lost, but cultures from the cavity of the uterus and from the blood should be taken immediately.

The last few years have seen an interest aroused in the question of thrombophlebitis and its surgical treatment—with results which are not at first sight encouraging, but may readily be improved upon.

We give some figures relating to puerperal infections in general, compiled in large measure from those quoted by Jeannin.¹ The death-rate from puerperal infection in all labours is given as 0.25 to 0.3 per cent, and the mortality of puerperal sepsis represents about 10 per cent of all cases, including, of course, very many mild cases. If only the more serious cases of puerperal infection are considered, the death-rate is at least 30 per cent.

The following table shows the relative proportion of the different forms of fatal infections, with the respective death-rate:—

TABLE SHOWING THE RELATIVE PROPORTION OF THE DIFFERENT FORMS OF FATAL INFECTIONS, WITH THE RESPECTIVE DEATH-RATE.

Condition	Percentage of total cases	Mortality per cent
True septicæmia - - - - -	40	95
General peritonitis - - - - -	20	85
Pyæmia - - - - -	15	72
Sloughing endometritis (sapræmia) and abscess -	15	75
Pneumonia and pleurisy - - - - -	7	—

A rough indication of the prognosis is also to be gained by a knowledge of the infecting organism; streptococcal organisms are obtained from the uterus in 50 to 75 per cent of all cases; they are the most to be feared—streptococcal cases are much more generally fatal than those due to any other organism. Staphylococcal infections seldom give rise to a septicæmia, but commonly enter into local lesions. *B coli* infections are comparatively rare, but are said to be dangerous on account of their action on the liver. Gonococcal infections most frequently end in tubal disease and adhesions, which engender sterility; it is seldom that they prove directly fatal.

It has been noted that infections which have taken on an epidemic form are as a rule much more virulent than the average run of sporadic cases. The explanation is to be found in an acquired virulence during the passage through the human body.

Prognosis from the Clinical Standpoint.—It is a good thing to have the following rule before one when investigating a case of puerperal sepsis. The gravity of an infection is in inverse ratio to the intensity of the local reaction; that is to say, where there is nothing found to account for the symptoms, the clinician will be guarded in his statements. The following factors are of varying importance:—

The condition of the patient, especially as to preceding obstetrical operations which have resulted in extensive bruising or the production of unclean wounds, may indicate a lower power of resistance. Cases of albuminuria, of eclampsia, and of severe hæmorrhage come under the same category, and provide a large proportion of cases of puerperal infection ending fatally.

In comparing post-abortion with post-partum cases, it is found that the latter are, generally speaking, much less favourable. An exception is to be made respecting the cases subsequent to efforts at criminal abortion, in which the mortality easily reaches 5 per cent.

As a general rule, the death-rate is higher in cases (with declared puerperal sepsis) *transferred to institutions* than in cases occurring within an institution.

The date of onset of the fever has an important significance. An infection which is evident within 24 to 36 hours after labour will cause anxiety from the outset, while cases occurring after the sixth day will almost certainly show only local lesions of a suppurative character.

The severity of the general symptoms bears a direct relation to the gravity of the septic infection. Thus, a temperature maintained at about 104° , a pulse of 110 to 120 per minute and remaining fast in spite of oscillations in the temperature reading, with a dry tongue and loss of sleep, are bad signs.

The correspondence between the pulse and temperature curves should be noted, as in bad cases the pulse is constantly higher than the temperature curve, and does not fall when the temperature is lowered. A slow pulse, irrespective of the temperature, may be taken as a good sign. In the worst cases there is incontinence and dyspnoea, and the extremities become cold. In the absence of vomiting or diarrhoea, and while the appetite remains and the patient receives nutrition, there is always hope that the resistance to disease will be effective.

Albumin in the urine and a diminution in quantity of the latter must be taken as unfavourable.

Jaundice is seen in cases of general peritonitis, and indicates wide extension of the latter. It is rare in such cases for recovery to take place. The condition must not be mistaken for the icteric tinge not infrequently seen in cases of severe septic infection with high temperature; such a tinge occurs in nearly all fevers, and does not imply a serious lesion of the liver tissues.

The blood furnishes information—in the first place bacteriologically, as indicating the presence or absence of micro-organisms. It is of some significance to try to distinguish the true septicæmias from the occasional bacteriæmias. Thus, a culture from the blood within an hour or two of a rigor will almost certainly contain bacteria; but the same patient's blood a few hours later may or may not reveal the presence of organisms. Such a discontinuous bacteriæmia has a much better prognosis than the continuous. Again, cultures taken when death is approaching are frequently found to reveal a *B. coli* infection, which is probably not the true causal agent. The presence of microbes does not necessarily indicate a bad prognosis, as Western,¹ in 96 cases of puerperal fever, found definite evidence of organisms in the blood, continuously or discontinuously, in 40 per cent. The mortality in these cases was: in the group treated by vaccines, 32 per cent; in the group treated by ordinary methods, 55 per cent. The absence of microbes in the blood is, of course, a good sign; but pneumonia, peritonitis, or some other complication, may cause a fatal issue.

In the second place, the blood has been examined from the point of view of leucocytosis. In the milder forms the white cells should range round 20,000, and the polymorphs should not exceed 90 per cent of the whole; while in the severe forms the leucocytosis reaches 50,000, the polymorphs represent 95 per cent of the whole, and there may be complete disappearance of the eosinophils.

Such *complications* as endocarditis, pericarditis, suppurative arthritis, and pneumonia are very serious indeed—while with the development of thrombosis of the leg, the infection often subsides.

The conditions prevailing in the pelvis help materially; when the lochia are normal and inoffensive, and the uterus small and firm, while the general symptoms are marked, the case is almost certainly one of septicæmic nature; on the other hand, cases with a large bulky uterus and offensive discharge, or a local swelling, are much more hopeful.

The Results of Treatment.—These would appear to be more a matter of recognizing the type of infection and applying thereto the appropriate treatment. The difficulties of diagnosis are immense. For instance, there is no doubt that operative procedures offer the best chances in cases of thrombophlebitis, yet clinically it is nearly impossible to distinguish these cases from the true septicæmias—in fact, the two frequently co-exist.

We shall, however, consider the figures given by different authorities for the various forms of treatment.

The conservative treatment, where douching, drugs, and local applications are used according to the clinical manifestations, show a wide variation in mortality, depending on the observer.

MORTALITY IN CASES TREATED BY ORDINARY METHODS.

Authority						Mortality
						per cent
Notified cases	-	-	-	-	-	58·0
Western ¹ (44 cases)	-	-	-	-	-	55·0
Western (bacteriæmias)	-	-	-	-	-	87·5
Johnstone ² (Belvedere Hospital)	-	-	-	-	-	42·0
Jeannin ³	-	-	-	-	-	30·0
Stookes ⁴ (Monsall Hospital in 1910—75 cases)	-	-	-	-	-	19·7

Stookes⁴ included all cases admitted, and it is not stated whether vaccines were used or not. Great variation exists in deciding what constitutes a puerperal infection : thus, Jeannin³ places the figure at 10 per cent if all puerperal infections are included.

Vaccines have recently been extensively used in this country and in America. The largest series was treated at the London Hospital, and published by Western.¹ He claims that it is possible to reduce the mortality by half by using autogenous vaccines. Thus, in 56 cases treated with vaccines, the mortality was 32 per cent ; in 44 treated without vaccines, it was 55 per cent. Still more striking are his figures in those cases where there were organisms present in the blood at the time of culture ; in bacteriæmias treated without vaccines, the mortality was 87·5 per cent ; in those treated with vaccines, it was 52 per cent. Western, however, was of opinion that vaccines were not so useful in the severe type of cases in which death usually ensued within ten days of the onset. He also found stock vaccines unsatisfactory. Polak,⁵ using polyvalent vaccines, had only 6 deaths in 28 cases of streptococcal bacteriæmia, i.e., 21·4 per cent ; and in 12 staphylococcal infections only 1 died, a mortality of 8·3 per cent.

Antistreptococcal or antipuerperal sera have now received an extensive trial. They do not appear to have been successful. Johnstone² says he has seen no benefit from their use. Jardine⁶ used polyvalent sera in 25 cases, with benefit in only 2. Bonstedt,⁷ however, believes they have been of much service in a series of 26 cases in which he employed them.

Injections of a 2 per cent sterile solution of magnesium sulphate have recently been used. In this way James A. Harrar⁸ treated 14 cases of severe septicæmia—in 5 cases streptococci were isolated from the blood, with 1 death ; while in the other 9 cases streptococci were cultured from the uterus, and again 1 died. He finds this method useless in thrombophlebitis, pus collections, and chronic pyæmias. To obtain good results the treatment must be undertaken early.

The operative treatment of thrombophlebitis still shows a very high mortality. Jeannin, Vanverts, and Paucot⁹ collected 82 cases up to 1912, with a mortality of 59·8 per cent. But it must be remembered that this list includes some of the first operations, and also many hopeless cases. Thus, in some cases there was thrombosis of pelvic and uterine veins of both sides, of ovarian, and even of the hypogastric veins. The cases operated upon within the last year or two would show more favourable results. On the other hand, it appears that thrombosis of the veins is found in the majority of puerperal infections, and in less than one-third it constitutes the only lesion ; of these latter, it appears that the thrombosed vessel is capable of satisfactory surgical treatment in 70 per cent.

REFERENCES.—¹Lancet, 1912, Feb. 10 ; ²Jour. Obst. and Gynæcol. Brit. Emp. 1912, June, 367 ; ³Pratique de l'Art de l'Accouchement, 1914, 3rd edition, vol. i, 640 et seq. ; ⁴Jour. Obst. and Gynæcol. Brit. Emp. 1913, March, 178 ; ⁵Jour. Amer. Med. Assoc. 1911, Nov. 25 ; ⁶Jour. Obst. and Gynæcol. Brit. Emp. 1912, June, 378 ; ⁷Monats. f. Geb. u. Gynäkol. xxiv, Heft i, 46 ; ⁸Amer. Jour. Obst. 1913, Nov. ; ⁹Arch. Mens. d'Obst. et de Gynécol. 1912, Nov.

PULMONARY TUBERCULOSIS.—The prognosis in pulmonary tuberculosis in an individual case is extremely difficult, so much so that it has been said that he who attempts it can be sure of one thing only, and that is that he will be mistaken. Patients who appear to be doing well, and in whom the disease seems to be almost arrested, may, and often do, suffer a relapse brought about by fatigue, intercurrent illness, or other cause, or may die from hæmoptysis, meningitis, or pneumothorax. For example, a doctor who had recovered from an acute attack of the disease, who had doubled his weight, and was capable of walking fifteen miles with no rise of temperature, as the result of sanatorium treatment, suffered a severe relapse owing to an afternoon's enthusiastic tobogganing. This laid him up in bed for five months, and rendered him a more or less permanent invalid during the remainder of his life.

On the other hand, every physician of wide experience in this disease comes across numerous instances of patients whose life at some time or other has not appeared likely to be prolonged for more than a few months, and who nevertheless make a surprisingly good recovery. Three examples from my own experience may be given.

A Frenchman living in New York, who was apparently dying, was anxious to go to Paris to take farewell of his family, and consulted a number of physicians on the subject. All except one thought he would die on the voyage, and advised him not to undertake it. He, however, went to Paris, taking a coffin with him on the voyage. He improved somewhat, and then went to a well-known sanatorium, where he became so much better that he was able to take up his work again. He lived an adventurous life in all climates, and often faced conditions which would have tried a strong, healthy man. When he consulted me some fifteen years later, there was no active disease, but much fibrosis, and some dry excavation, together with shortness of breath. He died two years afterwards from profuse hæmoptysis.

A working man came to my out-patient room at the Brompton Hospital, apparently in the last stages of the disease. Both lungs were extensively infiltrated, with signs of excavation in three lobes, a large laryngeal ulcer was present, and the temperature was 103°. The man refused to go to an infirmary, and it was impossible to get a bed for him in a home for the dying. A philanthropic lady gave the necessary funds for him to be boarded out in the country. He had practically no medical treatment, but when I saw him a year later, all signs of active disease had gone, satisfactory fibrosis had taken place, the laryngeal ulcer was completely healed, and his general condition was so satisfactory that he was sent to the Frimley Sanatorium, where he reached the highest grade of labour. He continued to do well for some years, although he never returned to his occupation, preferring to live on the charity of the lady who had befriended him when he was thought to be dying.

A doctor who had just qualified was found to be in an early stage of the disease, and led an open-air life for two or more years. When I saw him, some thirty years afterwards, he was capable of very hard work; and he told me that apart from an occasional attack of fever lasting a week or two, he had been able to cope single-handed all this time with a practice which was so arduous that although he kept four horses he was never able to drive a pair. The whole of the left lung was infiltrated, and there was an unusually large cavity in the lower lobe. This patient died, when over seventy, from cerebral hæmorrhage.

These cases are sufficient to show the folly of making too dogmatic statements about the future of anyone suffering from pulmonary tuberculosis. Nevertheless, certain wide general statements may be made on the subject of prognosis. In the first place, pathological investigations show that the defensive forces of the body are capable of defeating the invading tubercle bacillus with extraordinary frequency, and that many persons suffer from slight degrees of pulmonary tuberculosis and recover completely. In fact, pathological evidence is the strongest we have to demonstrate the curability of the disease. It shows us that many persons contract consumption, and yet recover without their condition being diagnosed. Clinical evidence, similarly, shows that a number of persons have the disease in such a slight form that a short holiday, or a few months' rest under open-air conditions, brings about a complete restoration to health. In fact, it is probably true that at least 20 per cent of the cases of pulmonary tuberculosis in which a clinical diagnosis can be made, end in recovery whatever the treatment, and sometimes in spite

of treatment. In other instances the disease has obtained a firmer hold, and more prolonged and rigid treatment is required to enable the defensive forces of the body to gain the victory; and in yet other cases, some of them diagnosed in the early stages, no form of treatment appears to have much, if any, effect in arresting the activity or the progress of the disease.

These differences are due to the fact that in this, as in every form of infective disease, we have a constant war between the invading micro-organisms and what may be termed comprehensively the defensive forces of the body. The latter are complicated things, and upon their response to the invading organisms or their products depends the question of recovery or of extension of the disease and eventual death. The questions of recovery, partial recovery, and arrest, or gradual extension of the tuberculous process, depend upon the ratio of the virulence of the bacilli and the specific resistance of the defensive forces of the body under the particular conditions of the individual case. If there is no response on the part of the defensive forces, or if the response is such that the toxic effect of the bacilli or their products is not neutralized, the inflammatory process continues, and the disease extends.

In prognosis, therefore, we are faced with the problem: How will the defensive forces respond to the attack? If the bacilli are virulent and the patient's strength is undermined, the outlook, even with opportunities for satisfactory methods of treatment, commenced at an early stage of the disease, is bad. If the bacilli and their products elicit an effective response, and the conditions for treatment are satisfactory, the outlook is far more favourable.

Factors influencing the Prognosis.—From the above it will be clear that in the prognosis of this disease the most important factor to be taken into account is *the response of the defensive forces*. If the patient suffers from toxic effects such as malaise, loss of appetite and of weight, fever to 99° or more when at rest, we know that the response is ineffective, and that the disease, being active, is extending. On the other hand, if the patient loses his sense of fatigue, gains weight, has an afebrile temperature, and has less signs of local irritation, such as diminution in the amount of expectoration, we know that the response is effective.

The above reasoning helps us to understand how *different types of the disease* are associated with a varying prognosis, and how the prognosis depends upon the varying conditions of life, environment, and constitution of the individual patients. In established miliary tuberculosis the outlook is hopeless; in acute caseous tuberculosis, associated with fever and other signs of toxæmia for several months, it is always grave, as it is in the comparatively rare form of pneumonic tuberculosis in adults. In the pneumonic form in children, the portion of lung affected not infrequently breaks down, a cavity is rapidly formed, the caseous matter is expectorated, the disease ceases to extend, and the patient recovers.

Again, *the state of the patient's previous health* has a marked effect upon his capacity to respond. Thus, when pulmonary tuberculosis is grafted on such diseases as chronic Bright's disease, diabetes, or cancer, it is incapable of cure, and only accelerates the end. Similarly, the development of such complications as chronic albuminuria or glycosuria in a case of pulmonary tuberculosis is of the gravest significance. As a further example of this point, it may be mentioned that the death-rate from pulmonary tuberculosis in lunatics approaches 25 per cent. A chronic alcoholic rarely recovers from consumption. Syphilis often leads to the subsequent development of tuberculosis, and is a grave complication of the disease; in many instances in which it is difficult to explain the unsatisfactory progress of a case, it will be found that there is a history of previous syphilis, with the persistence of a positive Wassermann test. Further, a consumptive who is also an alcoholic and a syphilitic may be regarded as having practically no chance of recovery.

The earlier the disease is diagnosed and the patient brought under efficient treatment, the better is the outlook; but even if the diagnosis is made in the earliest stages, and efficient treatment is immediately undertaken, at least 10 to 15 per cent of the cases fail to make an efficient response, and a fatal ending is brought about in from one to three years. On the other hand, the mere fact that the disease is in an advanced stage when discovered does not preclude recovery. In a number of instances in which the

disease is advanced there has been very good resistance, and but little is required to make the defensive forces victorious. Thus, a working man who has continued his work under bad conditions whilst the disease has made slow but considerable progress, and until he is forced to seek advice, will often do well when placed under more helpful conditions.

The character of the onset, apart from the forms of the disease already discussed, has an effect on the prognosis. When the first symptom is hæmoptysis, patients often do very well. This is largely accounted for by the fact that this symptom alarms the patient and impresses him with the necessity for treatment at a time when there is only a slight amount of infiltration. When the onset is pleuritic, and efficient treatment is commenced at once, the outlook is usually favourable.

Family characteristics have some bearing on this question. If two or more members have died from the disease without any real response having been made to the infection, it is a fair deduction that the resistance of the family is poor; and if another member of the family contracts the disease, the outlook as a rule is not satisfactory.

Apart from the above considerations, the most important factors are—the character of the patient; his facilities for treatment; and the conditions he has to face after the disease has become arrested.

Everything depends on *the character of the patient*. This has been expressed more forcibly by the statement that in this disease it is “impossible to cure a fool”. The patient must depend on himself; his doctor can direct him, but unless he is prepared to devote himself whole-heartedly to the details of treatment until the arrest of the disease has continued for at least two years after the resumption of work, his chance of permanent recovery is small.

The question of *facilities for treatment* speaks for itself; the value of different forms of treatment is discussed later.

The after-conditions are important. It is often said that treatment of this disease is a failure, because so many relapses take place when it appears to have been arrested. If a man breaks his leg by tripping over orange peel, has it firmly united by proper treatment, and subsequently fractures it again by once more slipping on orange peel, it is no reflection on the treatment given. If a man owing to bad conditions has his defence so undermined that he contracts tuberculosis, it is no reflection on sanatorium treatment if, after the disease has undergone arrest, he suffers from a relapse as the direct result of returning to precisely the same conditions as those under which the disease originated. The essential things in the after-conditions are the avoidance of fatigue, the avoidance of impure air (rather than the necessity of making a fetish of open-air conditions), and the opportunity of having a rest at once if slight illness, such as a feverish cold, or symptoms of renewed activity of the disease, occur. Fatigue is the usual cause of relapse, and in many instances it is fatigue produced in the excitement of sport.

In concluding this part of the subject, we may say that if the disease is acute and no response is made, death may take place in three months, and is seldom delayed much beyond two years. If we consider the cases which end fatally in the consumption hospitals—and most of these cases are presumably of the more acute type—the majority (to the extent of 80 per cent) have a duration of less than three years, and only about 6 per cent have a duration of over four years.

This type of the disease may be recognized by certain clinical signs, as these are an index to the activity of the disease. So long as fever continues, the disease is active. If fever is not reduced by absolute rest, and continues for some months, the outlook is always extremely grave. Again, if slight degrees of exercise always produce fever, which persists in spite of rest, the case is an unfavourable one. In such instances the production of rest to the affected lung by means of a pneumothorax induced by nitrogen gas, more especially when this method is adopted at an earlier stage than is usually the case at present, may do much to prolong life and, in a certain number of cases, to bring about permanent arrest.

The pulse, like the temperature, is an index to the activity of the disease, and a persistently rapid pulse-rate, or one which is readily increased by exertion, is associated with an unsatisfactory prognosis. A sense of malaise or easy fatigue is similarly indicative of a poor response on the part of the patient's defensive forces; and its persistence

in spite of treatment, like the persistence of other signs of toxæmia, such as loss of weight, sweating, etc., is associated with a bad prognosis.

The extent or character of physical signs is of little assistance in determining the activity of the disease; the important things are the degree of toxæmia and the response of the individual. Increase of expectoration and repeated hæmorrhage usually signify that the patient's chances are diminishing. The persistent presence of tubercle bacilli in his expectoration is often associated with failure to arrest the process, but bacilli continue to be present in the sputum of many patients who retain their health and capacity to work for years. In fact, we have tubercle carriers just as we have typhoid carriers. The presence of secondary organisms in the sputum is not necessarily indicative of secondary infection, and many patients who suffer from pulmonary tuberculosis associated with bronchitis live long and useful lives. When secondary organisms have invaded the tuberculous tissue, the hope of recovery is greatly diminished. A further point is that a persistent diazo-reaction of the urine is usually associated with an unfavourable prognosis.

When the response of the patient is more satisfactory than in the acute cases, but still inadequate, or when the response is adequate but the conditions of life after arrest has been brought about are unsatisfactory, the mean duration of life probably does not exceed seven to eight years. Stadler showed that of 670 male and female patients in the first and second stages of the disease who were not treated in a sanatorium, 54 per cent were alive at the end of six years, and 44 per cent at the end of seven. Of these 670 patients, only 40 per cent were capable of full work at the end of four years; whereas, of 716 patients treated at the Prussian and Hessian Railway Sanatorium, 60 per cent were capable of full work at the end of five years.

When the response is adequate and the after-conditions are satisfactory, the prognosis is good, and many patients are capable of leading very active lives for a number of years.

Finally, it may be said that when a patient who has suffered from pulmonary tuberculosis feels well (probably, in sensible patients, the most reliable guide of all), has a normal temperature, maintains a satisfactory weight, and has no return or increase of expectoration, he may be satisfied as to his condition, no matter what physical signs may be present. Conversely, a feeling of malaise, a raised temperature, continued loss of weight, and a return or increase of expectoration, apart from a temporary cold, indicates the presence of toxæmia and a return of the activity of the disease.

Efficient treatment has much effect on the future of a large proportion of consumptives. As they rely on their defensive forces they require good hygienic conditions—i.e., pure air, sufficient food. The most important thing in their treatment is the regulation of the amount of exercise in such a way that the auto-inoculations produced stimulate the defensive forces of the body, but never paralyze them. This is the principle underlying sanatorium treatment. The figures given below suggest that climatic necessities have been overrated in the past; that good results are obtained from sanatorium treatment; and that these are somewhat improved by the careful use of tuberculin. In a certain number of carefully selected cases partial or complete compression of a lung by nitrogen gas (artificial pneumothorax) gives good results.

Effects of Climate.—We have conclusive evidence that pulmonary tuberculosis is capable of undergoing complete arrest in practically any kind of climate. Thus, good results have been obtained in Russia below sea-level, and in low-lying Holland. Conversely, the death-rate from this disease among Red Indians in the Rocky Mountains—one of the finest climates in the world—is stated to be 25 per cent of the total mortality. This is doubtless due to the conditions under which the Indians live, and emphasizes the importance of the immediate environment. The theory that treatment at high altitudes is far superior to all other climatic or hygienic forms of treatment is not supported by modern observations. Perhaps the most important evidence in this respect is that of Professor Saugmann, who has contrasted the results obtained by him at the Vejle fjord Sanatorium in Denmark with those obtained by Turban at Davos. The Vejle fjord Sanatorium is a few feet above the sea; Davos has an altitude of 5000 feet. At the Danish sanatorium the average stay of patients was 176 days, whereas at Davos it was 222 days. Again, Turban's patients were drawn from a richer class, who would be in a better position to look after themselves when they had left the sanatorium. In spite

of these disadvantages, the results obtained by Professor Saugmann, given below, compare favourably with those obtained by Turban, and show conclusively that a high altitude is not essential to the successful treatment of consumption.

PERCENTAGE OF PATIENTS FROM WHOSE EXPECTORATION TUBERCLE BACILLI
DISAPPEARED DURING TREATMENT.

Stage	Turban's sanatorium	Vejlefjord sanatorium
I	74	79
II	41	65
III	11	17

PERCENTAGE OF PATIENTS WHO SUFFERED FROM FEVER ON ADMISSION
BUT BECAME AFEBRILE DURING TREATMENT.

Stage	Turban's sanatorium	Vejlefjord sanatorium
I	85	83
II	80	96
III	44	69

PARTICULARS OF AFTER-HISTORY OF PATIENTS IN WHOSE EXPECTORATION
TUBERCLE BACILLI WERE PRESENT DURING STAY AT SANATORIUM.

After-history	STAGE I		STAGE II		STAGE III	
	Turban's sanatorium (after 1-7 years)	Vejlefjord sanatorium (after 2-10½ years)	Turban's sanatorium (after 1-7 years)	Vejlefjord sanatorium (after 2-10½ years)	Turban's sanatorium (after 1-7 years)	Vejlefjord sanatorium (after 2-10½ years)
	per cent	per cent	per cent	per cent	per cent	per cent
Able to work - - -	94·7	91·4	54·0	71·3	16·8	24·7
Unable to work on account of tuberculosis - -	5·3	—	13·7	2·0	7·9	5·3
Died from tuberculosis -	—	8·6	29·6	25·7	72·2	67·3
Unknown - - -	—	—	2·7	1·0	3·0	1·2

PARTICULARS OF AFTER-HISTORY OF PATIENTS WHO WERE ADMITTED TO SANATORIUM
WITH FEVER.

After-history	STAGE I		STAGE II		STAGE III	
	Turban's sanatorium (after 1-7 years)	Vejlefjord sanatorium (after 2-10½ years)	Turban's sanatorium (after 1-7 years)	Vejlefjord sanatorium (after 2-10½ years)	Turban's sanatorium (after 1-7 years)	Vejlefjord sanatorium (after 2-10½ years)
	per cent	per cent	per cent	per cent	per cent	per cent
Able to work - - -	90	100	44·4	77·1	12·3	20·5
Unable to work on account of tuberculosis - -	—	—	14·4	—	7·4	3·9
Died from tuberculosis -	5	—	37·8	22·9	77·7	75·6
Unknown - - -	5	—	3·3	—	2·5	0·5

Climate, naturally, cannot be ignored. Much better results are obtained in cold or temperate climates than in hot or tropical ones. Again, results are not so good in situations which are damp, or wind-swept and exposed, as in dry or more protected

situations. A change of climate is as beneficial to the consumptive as to others, but not essential. In suitable cases, an after-cure at an altitude is of service in expanding the lungs.

In the later stages, life is probably prolonged if the patient is able to avoid marked climatic changes, and to reside at some place where the conditions are suitable for the particular indications of the case.

The Results of Sanatorium Treatment.—The results obtained by treatment in a sanatorium vary, as might be anticipated, according to the condition of the patient and the character of the lesion at the time treatment is commenced. The results obtained when treatment is commenced in what is known as Turban's Stage I* are far better and more lasting than those obtained when treatment is commenced in Stage III. Further, the results are more lasting according to the class from which the patient is drawn and according to the character of his work and surroundings. In the case of the working classes, about 50 to 60 per cent of those treated in Stage I may be expected to be capable of work five years after their discharge from the institution; whilst in those belonging to the upper classes, the percentage given by some authorities is as much as 80 to 90.

It is unwise to rely too much on statistical proof under present conditions, for it is difficult to compare data from different institutions, owing to the different methods adopted in classification and treatment. For example, in some institutions a proportion of patients receive tuberculin; in others, this remedy is not used. Certain broad conclusions, however, may be drawn, and the statistics of the results of sanatorium treatment given below are useful for that purpose. These are largely taken from the excellent chapter on this subject in Sir R. Douglas Powell and Sir P. Hartley's book on *Diseases of the Lungs and Pleuræ*, 5th edition.

The statistics of Dr. John Gray, which are confirmed and improved upon by other English observers such as Dr. Burton Fanning, show the capacity for work at varying intervals. They also show that of the 267 patients treated in an early stage, 46 were known to be dead and 50 were lost sight of in 1908; whereas of the 317 patients treated in an advanced stage, 207 were known to be dead.

I.—SHOWING RESULTS OF SANATORIUM TREATMENT IN 267 CASES OF EARLY PULMONARY TUBERCULOSIS (STAGE I, TURBAN) ADMITTED TO THE STANHOPE SANATORIUM DURING THE YEARS 1900–1908.

Year of admission	CASES DISCHARGED		CONDITION TO APRIL 30, 1908					Percentage known to be at work on April 30, 1908
	Total	Returned to work	At work	At home	Dead	Lost sight of	Re-admitted*	
1900–1901	14	14	7	—	2	5	—	50·0
1901–1902	26	23	8	1	10	7	1	30·8
1902–1903	20	21	7	1	5	7	1	35·0
1903–1904	33	28	18	1	6	8	1	54·5
1904–1905	35	30	16	4	11	4	2	45·7
1905–1906	37	35	17	5	7	7	1	46·0
1906–1907	51	45	29	6	4	12	—	56·9
1907–1908	51	43	34	15	1	—	1	66·7
Totals	267	239	136	33	46	50	7	50·0

* Not included in the total cases discharged during the year.

*Turban's classification may be described as follows:—

Stage I.—A slight lesion which does not exceed one lobe or two half-lobes.

Stage II.—A slight lesion which extends further than in Stage I, but at most to two lobes; or a severe lesion which extends, at most, to the volume of one lobe

Stage III.—All lesions which are not included in Stage I or II.

N.B.—A slight lesion is equivalent to infiltration: a severe lesion is equivalent to consolidation and excavation.

II.—SHOWING RESULTS OF SANATORIUM TREATMENT IN 317 CASES OF ADVANCED PULMONARY TUBERCULOSIS (STAGE III, TURBAN) ADMITTED TO THE STANHOPE SANATORIUM DURING THE YEARS 1900–1908.

Year of admission	CASES DISCHARGED		CONDITION ON APRIL 30, 1908					Percentage known to be at work on April 30, 1908
	Total	Returned to work	At work	At home	Dead	Lost sight of	Re-admitted.*	
1900–1901	12	3	—	—	12	—	—	0·0
1901–1902	20	8	2	—	17	1	—	10·0
1902–1903	31	17	2	—	26	3	1	6·5
1903–1904	29	11	3	—	26	—	—	10·3
1904–1905	37	19	6	1	27	3	2	16·2
1905–1906	68	25	7	8	46	7	1	10·3
1906–1907	62	23	10	9	41	2	3	16·1
1907–1908	58	24	14	32	12	—	—	24·1
Totals	317	130	44	50	207	16	7	13·9

* Not included in the total cases discharged for the year.

The statistics of the German State Sanatoria, although not strictly comparable, as they refer to all classes of cases, show that 44 per cent of the male and 51 per cent of the female patients were capable of working four to five years after their discharge from the institution.

III.—SHOWING THE IMMEDIATE AND AFTER-RESULTS IN MALE PATIENTS TREATED IN GERMAN SANATORIA UNDER THE PROVISIONS OF THE INVALIDITY INSURANCE LAW DURING THE YEARS 1904 TO 1908.

Year of treatment	Number of patients	Immediate results, showing percentage capable of work after leaving the sanatorium	After-results, showing the percentage of patients capable of work at the end of various years after leaving the institution				
			1904	1905	1906	1907	1908
1904	16,957	79	73	61	53	48	44
1905	19,085	81	—	76	63	54	49
1906	21,959	82	—	—	77	65	55
1907	22,258	81	—	—	—	77	65
1908	26,437	81	—	—	—	—	77

IIIA.—SHOWING THE IMMEDIATE AND AFTER-RESULTS IN FEMALE PATIENTS TREATED IN GERMAN SANATORIA UNDER THE PROVISIONS OF THE INVALIDITY INSURANCE LAW DURING THE YEARS 1904 TO 1908.

Year of treatment	Number of patients	Immediate results, showing percentage capable of work after leaving the sanatorium	After-results, showing the percentage of patients capable of work at the end of various years after leaving the institution				
			1904	1905	1906	1907	1908
1904	6,520	81	76	66	59	55	51
1905	7,536	83	—	78	67	60	55
1906	9,063	85	—	—	81	70	63
1907	9,816	84	—	—	—	80	69
1908	12,288	86	—	—	—	—	82

PULMONARY TUBERCULOSIS

Slightly better results have been obtained in other German sanatoria. Thus, in the case of the Prussian and Hessian Railway Company employees, 60 per cent were capable of full work five years after leaving the sanatorium, although a considerable proportion of the cases (26 per cent in 1908) were in Turban's Stage III.

IV.—SHOWING THE IMMEDIATE AND AFTER-RESULTS OF SANATORIUM TREATMENT AMONG THE EMPLOYEES OF THE PRUSSIAN AND HESSIAN RAILWAY COMPANIES DURING THE YEARS 1904 TO 1908.

Year of treatment	Number of patients	Figures showing the percentage of patients capable of full work at the end of various years after leaving the institution				
		1904	1905	1906	1907	1908
1904	716	81·7	74·6	66·6	63·0	59·6
1905	810	—	85·3	76·7	71·8	68·1
1906	1,180	—	—	85·8	70·0	73·0
1907	955	—	—	—	81·0	73·0
1908	1,152	—	—	—	—	82·5

In patients belonging to the upper classes, the results of sanatorium treatment show that in the early cases a larger percentage are capable of work than is shown by the statistics for the working classes, and confirm the observation that treatment in the later stages is seldom accompanied by satisfactory results for any length of time.

Dr. Noel Bardswell has given the results (*see Table VI*) obtained in the case of patients treated by him at the Mundesley Sanatorium from 1901 to 1905, as observed to the year 1909.

Careful observations in the same direction have been made by Dr. Lawrason Brown and the late Mr. E. G. Pope on the results obtained in 2222 patients, admitted in all stages of the disease, who were treated at the Adirondack Cottage Sanatorium in New York State (*Table V*). The immediate results gave a percentage of 56 apparently cured and 32 arrested out of 620 early cases.

V.—SHOWING THE CONDITION ON DISCHARGE OF 2222 PATIENTS ADMITTED TO THE ADIRONDACK COTTAGE SANATORIUM, NEW YORK STATE, U.S.A.

Condition on admission	Number of patients	CONDITION ON DISCHARGE			
		Apparently cured (per cent)	Disease arrested (per cent)	Disease active (per cent)	Died in the sanatorium (per cent)
Incipient cases - -	620	56	32	11	0·03
Moderately advanced - -	1329	12	46	40	2·00
Far advanced - -	273	0	16	78	6·00

The *after-results* of these cases, calculated in terms of 1000, showed :—

- 1. That 750 patients out of 1000 discharged as apparently cured survived at the end of 15 years, as against 850 out of 1000 of the general population.
- 2. That the expectancy of life in those discharged with arrested disease (which includes 32 per cent of the incipient cases, 46 per cent of the moderately advanced, and 16 per cent of far advanced) was between seven and eight years.

Results of Tuberculin Treatment.—It is difficult to prove by any method other than the personal supervision of a large series of cases that tuberculin is of the value in pulmonary tuberculosis that most authorities on this disease consider it. Statistics are open to many fallacies when used for such a purpose; but it is recognized—much more

VI.—SHOWING RESULTS OBTAINED IN 241 MALE AND FEMALE PATIENTS BELONGING TO THE UPPER CLASSES TREATED AT THE MUNDESLEY SANATORIUM, NORFOLK, DURING THE FIVE YEARS 1901 TO 1905.

All Cases considered together.

Year of discharge	Number discharged	Number known to be well or alive on January 1 of each year since discharge								Condition of patients on January 1, 1909 (percentage in brackets)
		1902	1903	1904	1905	1906	1907	1908	1909	
1901	58 (5)	49	39	33	27	26	24	22	20	Well 99 (41.0)
1902	53	—	48	39	35	32	31	30	26	Alive 15 (6.2)
1903	55 (2)	—	—	52	43	36	35	34	32	Died 101 (41.9)
1904	34	—	—	—	33	31	29	29	28	Died in } 19 (8.0)
1905	15	—	—	—	—	13	12	9	8	sanatorium
	215*									Lost sight of 7 (3.0)
										Total 241

* In addition to these 215 cases, 7 patients (figures in brackets) were discharged but have since been lost sight of, and 19 died in the sanatorium, making the total treated 241.

Incipient Cases.

1901	10 (2)	10	10	10	9	9	8	7	6	Well 46 (74.0)
1902	15	—	15	14	14	14	13	13	12	Alive 1 (1.6)
1903	18 (2)	—	—	18	16	16	15	15	15	Died (0)
1904	11	—	—	—	11	11	11	11	11	in sanatorium) } 11 (17.6)
1905	4	—	—	—	—	4	3	3	3	Lost sight of 4 (6.4)
	58†									Total 62

† In addition to these 58 cases, 4 patients (figures in brackets) were discharged but have been lost sight of, making the total treated 62.

Moderately Advanced Cases.

1901	24 (3)	23	17	15	12	11	11	11	11	Well 47 (49.4)
1902	19	—	19	16	15	14	14	13	12	Alive 10 (10.5)
1903	25	—	—	24	21	16	16	16	15	Died (1)
1904	16	—	—	—	16	16	15	15	14	in sanatorium) } 35 (36.8)
1905	7	—	—	—	—	7	7	5	5	Lost sight of 3 (3.1)
	91‡									Total 95

‡ In addition to these 91 cases, 3 patients (figures in brackets) were discharged but have since been lost sight of, and 1 died in the sanatorium, making the total treated 95.

Far-advanced Cases.

1901	24	16	12	8	6	6	5	4	3	Well 6 (7.1)
1902	19	—	12	9	6	4	4	4	2	Alive 4 (4.7)
1903	12	—	—	10	6	4	4	3	2	Died (18)
1904	7	—	—	—	6	4	3	3	3	in sanatorium) } 74 (88.0)
1905	4	—	—	—	—	2	2	1	—	Lost sight of 0
	66§									Total 84

§ In addition to these 66 cases, 18 patients died in the sanatorium, making the total treated 84.

strongly by physicians in Germany, Switzerland, and America than by most physicians in England, it is fair to add—that tuberculin is of considerable value both as regards the immediate and ultimate results of treatment. If this were not so, the great extension in the use of this remedy seen both in Germany and England would be unaccountable: for example, in 1905 tuberculin was employed in 36 out of 123 private and public sanatoria in Germany; in 1906, in 57 out of 132; and in 1907, in 77 out of 135. In three years, then, the figures rose from 29 to 57 per cent. To my mind, the best summing up on this subject is that of Dr. Lawrason Brown, who says, “Tuberculin when properly given does no harm, may produce no apparent result, and may markedly benefit an individual patient who can follow at the same time the hygienic-dietetic treatment while in a health resort, at home, at rest, or at work. Some patients, even in advanced stages, reap great benefit. The immediate and ultimate results are improved, fewer relapses occur, and more patients lose the tubercle bacilli in their sputum.” My own experience is to the effect that patients suffering from consumption, and in whom there are no contra-indications against the use of tuberculin, not only lose their bacilli in greater numbers when tuberculin is *effectively administered* than patients who do not have this remedy, but suffer from relapses less frequently.

Statistics on such a subject tend to be fallacious, but a few may be given to support the above generalizations. The problem may be discussed from, amongst others, the three following points of view: (1) The disappearance of tubercle bacilli from the expectoration; (2) The immediate results of treatment from a clinical standpoint; (3) The ultimate results.

1. *The Disappearance of Tubercle Bacilli*.—Dr. Radcliff, of the King Edward VII Sanatorium, found that in patients treated by sanatorium methods and no tuberculin, the percentage of cases in which the bacilli disappeared was as follows: Stage I, 45·6 per cent; Stage II, 19 per cent; Stage III, 8·9 per cent; or taking all cases together, 23·3 per cent. Loewenstein, on the other hand, using a more searching technique, found that in patients treated by sanatorium methods *and* tuberculin, the percentage of cases in which the bacilli disappeared was as high as 52·9 per cent. Bandelier, in a similar series, found the percentage to be: Stage I, 100 per cent; Stage II, 87·3 per cent; Stage III, 44·2 per cent. Curschmann gives: Stage I, 80 per cent; Stage II, 47·7 per cent; Stage III, 33·7 per cent.

We may say, then, that so far as statistics go, there is evidence of the value of tuberculin in causing the disappearance of tubercle bacilli in all stages; and that when we take all cases in one group, we find that with sanatorium methods alone less than 25 per cent of the patients lose the bacilli from their expectoration, but that when tuberculin is added to the treatment the percentage is over 50.

2. *The Immediate Results of Treatment from a Clinical Standpoint*.—Trudeau found that in the incipient cases the results were very satisfactory with sanatorium methods alone, and that they were but slightly enhanced by the use of tuberculin. In the moderately advanced cases, 27 per cent of those in whose treatment tuberculin was given were cured, as against 6 per cent where tuberculin was not given; 55 per cent were arrested when tuberculin was given, as against 51 per cent when it was not; whilst 18 per cent remained active when tuberculin was given, as against 43 per cent when it was not.

3. *The Ultimate Results*.—Turban found that of 86 patients whose sputum contained bacilli and who were treated with tuberculin, 52·3 per cent are capable of work from one to seven years after their discharge from the sanatorium; whereas, of 241 patients whose sputum also contained bacilli and to whom no tuberculin was given, only 39·4 per cent gave a similar result. Ritter found that the following percentage of his patients were capable of work one to four years after their discharge from his sanatorium (50 being examined only about one year after their discharge):—

PATIENTS CAPABLE OF WORK ONE TO FOUR YEARS AFTER DISCHARGE
FROM SANATORIUM (RITTER).

Stage I.—Treated with tuberculin, 95 per cent; without tuberculin, 72 per cent									
„ II.—	„	„	„	82	„	„	„	57	„
„ III.—	„	„	„	50	„	„	„	22	„

Lawrason Brown's statistics show an advantage in favour of tuberculin, but to a slighter extent. Of his moderately advanced cases discharged with active disease, however, 41 per cent were alive of those treated with tuberculin one to fifteen years afterwards, as against 22 per cent of those not so treated.

More recently an investigation by Bardswell and Thompson of 384 cases treated at the Midhurst Sanatorium fails to show any advantage, immediate or remote, from tuberculin therapy. An actuarial investigation of the data of the Adirondack Sanatorium also fails to show that the addition of treatment by tuberculin to the sanatorium routine improved the results.

Results of Compressing a Lung by Nitrogen Gas (Artificial Pneumothorax).—It has been found that in cases in which one lung is comparatively sound, but no real progress is being made towards the healing of the affected lung, compression for many months of the diseased lung gives good results. In many cases compression is either limited in extent or impossible to procure owing to the presence of adhesions. In all cases the main factor in the results obtained by this special form of treatment is the selection of the case. Various authors put the percentage of cases suitable for treatment at about 5.

Saugmann selected 100 cases for treatment, but failed to produce compression in 36 of these owing to the presence of adhesions. Both groups were given sanatorium treatment and were followed up for between one-and-three-quarter and six years. The results obtained were as follows :—

RESULTS OF TREATMENT BY ARTIFICIAL PNEUMOTHORAX (SAUGMANN).

After-history	Compression (64)	No compression (36)
	per cent	per cent
Able to work - - -	50·0	22·2
Free from tubercle bacilli - -	50·0	8·6
Dead from tuberculosis - -	18·7	38·8

Other observers give somewhat similar figures. Carpi (1914), in reporting on 36 cases, found that 6, all of which but one were bad 'cavity cases', were cured. Shortle (1916) had 104 cases, in 79 of which he induced compression : of the inoperable cases, only 2 (8 per cent) were working at the time of the report, and only 1 (4 per cent) was improved ; of the patients in whom compression was produced, 22 (28 per cent) were working, and 19 (25 per cent) were in a good condition of health.

Results of Surgical Treatment (Thoracoplasty, etc.).—In cases of pulmonary tuberculosis in which compression by gas is either impossible or inadvisable, various surgical measures have in certain instances given good results. Of these, thoracoplasty is easily the most effective. In the hands of experienced surgeons with adequate knowledge of the technique of the operation and of local anæsthesia, surprisingly good results are obtained when the advanced character of the disease is taken into account. Some 30 per cent of patients operated on by this method recovered sufficiently to undertake light work. There is, however, a mortality of 10 per cent. Compression of cavities, cut off by adhesions, by means of paraffin or other substances, has also given good results. *Arthur Latham.*

PULSE, IRREGULARITIES OF THE.—The fundamental principle underlying accuracy of prognosis in cardiac arrhythmia is the same as that which has been enunciated in regard to cardiac pain ; the outlook in each case depends chiefly on the cause, for arrhythmia, like angina, is only a symptom, and not in itself a disease. There is, however, a difference between the two, for the type of irregularity that is met with gives valuable intelligence of itself as to the state of the myocardium ; and in any case of heart disease it is the myocardium, and especially that of the ventricles, that counts. Each kind of irregularity must therefore be considered on its own merits, as well as in connection with the associated lesions.

Sinus Irregularity.—This comes first in order of frequency, as well as of unimportance. This aberration, in which the whole heart, ventricle as well as auricle, participates is

always due to extracardiac causes, and is therefore never indicative of a cardiac lesion. Practically, therefore, it has no prognostic significance; though perhaps, when it develops in a case of meningitis or intracranial tumour, it may be regarded as evidence of increasing pressure within the skull, and assessed accordingly. From the cardiac point of view it is of the highest importance that we should recognize the lack of significance of this type of arrhythmia; for it is extremely common in childhood and youth; so common, indeed, that a child under ten with a perfectly regular pulse is a clinical curiosity. Nervous subjects are in like manner very prone to exhibit this alteration of rhythm. When the pulse, under the stress of supracardiac influences, shows an extreme degree of sinus irregularity, it is apt to alarm both patient and medical attendant, unless the latter has assured himself of its harmless origin. *The mere fact that a pulse is very irregular has no prognostic meaning*; yet there are many people crawling miserably through an invalid existence to-day because, being possessed of an exaggerated sinus irregularity in early life, they were labelled as having weak hearts, and were restricted as to exercise. Any medical officer to a public school can tell a tale of boys sent to school with certificates of unfitness for games, certificates which have no other basis than a sinus arrhythmia. A certificate of this type is tantamount to malpraxis; for in these days of graphic methods of analyzing the heart's rhythm, there is no excuse at all for such a mistake. Even when these methods are not available, much needless misery might be avoided if it could be realized that irregularity of the pulse, no matter how extreme, is of no significance in a child or adolescent who shows no other evidence of cardiac disease.

The Extrasystolic Type of Arrhythmia.—Of this condition almost the same may be said. Premature contractions, whether arising in auricle, ventricle, or junctional tissues, are due in some cases to the development of hypersensitive foci in the myocardium, in others to extracardiac influences; but not even in the first kind of case does the extrasystole count for much. As Sir James Mackenzie puts it, even in elderly people the extrasystole is of no more importance than the presence of tortuous temporal arteries. The writer has often seen extrasystoles develop in persons at or past middle life, without other signs of cardiac disease, and continue intermittently or persistently for years, without introducing any hurtful condition other than the mild panic which is often experienced by patients who have become aware of their own extrasystoles. Even in cases where the pulse is confused by a whole medley of these premature ectopic beats, the outlook is no worse than in cases where the extrasystole is occasional.

When this type of irregular pulse makes its appearance for the first time in a case of organic heart disease, it is rarely of any significance. There are two exceptions to this rule. The first of these is the case of the patient with advanced post-rheumatic disease of the mitral valve—cases which usually fall within the category of mitral stenosis. Here the appearance of auricular extrasystoles may sometimes foreshadow the descent of the heart into that condition of total irregularity which may be regarded as the beginning of the end (*vide infra*, 'Total Arrhythmia'). But this sequence is by no means inevitable, and it would be very bad practice to frighten the patient by any mention of its possibility. The other exception is sometimes encountered in persons whose ventricular contractility is becoming impaired by cardiosclerosis or other progressive myocardial disease. The case of the patient with a leaking aortic valve, atheromatous or syphilitic, furnishes an excellent example. In such a case, the development of premature beats may be enough to precipitate sudden and fatal breakdown of an already overburdened and inefficient ventricle. In cases less dramatically abrupt the supervention of frequent extrasystoles may nevertheless add to the burden of a ventricle that is already almost unable to carry on effectively. An extremely significant proof of this fact is occasionally furnished by the supervention of the alternating pulse (*vide infra*). In a few cases this alternating pulse is first, and for short periods, set in motion by an extrasystole; first comes an extrasystole, and then follows a bout of alternating beats. Even here, however, it is not so much the extrasystole as that which it 'unmasks' (to borrow Lewis's word) that is of grave import. But one may at least look for improvement in the condition of such a patient if the extrasystoles leave off.

As a general rule, therefore, it is true to say that the extrasystole may be ignored so far as the prognosis is concerned. There is no form of irregularity of which the patient himself is more painfully aware than this: and his restoration to a sense of well-being

is often largely dependent on the confidence with which his medical adviser is able to say that there is nothing the matter with him. The assurance that must necessarily underlie the delivery of such a statement is scarcely possible of attainment, in many cases, except by means of graphic analysis of the pulse irregularity, or apart from that familiarity with the meaning of the various kinds of arrhythmia which it is hard to acquire without the practice of graphic methods. There is no area in the whole range of medicine where accurate prognosis is more dependent on accurate diagnosis than that of cardiac arrhythmia.

Tachycardia.—This is the next kind of irregularity to be considered. Here it is first necessary to discriminate between quickening of the pulse by cardiac causes and that due to extracardiac influences. Tachycardias of the former class, such as those of hyperthyroidism and fevers, are of course outside the purpose of this paragraph. Tachycardia of cardiac origin (including in that term fast *regular* pulses only) may be persistent or paroxysmal. An important example of the former variety is that which is associated with acute ventricular failure. Of acute diseases diphtheria is perhaps the one that furnishes the best examples, while in chronic myocardial disease it may develop after a severe attack of angina. The beats are small, varying a little in amplitude and sometimes alternating, regular except for occasional premature beats, but of a low tension. This kind of pulse is associated with pallor, vomiting, and a liability to syncope, and is in fact proof of a very dangerous degree of ventricular inefficiency.

Paroxysmal tachycardia is a disorder characterized by attacks of rapid, regular pulse. Such attacks begin and end abruptly, without any gradual transition from or into the normal rate. Here the prognosis turns not so much on the nature of the attack itself as on the condition of the heart between and during the paroxysms. The best kind of case is that which occurs in an otherwise healthy young adult with no evidences of organic disease of the heart. The worst kind is that in which the patient is afflicted with advanced heart disease of the post-rheumatic or of the cardiosclerotic type, and in which each bout of tachycardia aggravates the signs of cardiac insufficiency (œdema, dyspnoea, alternating pulse, and the like). The import of paroxysmal tachycardia is graver, the older the patient; in persons at or past middle life these attacks are apt to reveal myocardial inadequacy, even where it was not otherwise suspected, in the following manner: when the heart has been beating at its heightened speed for a little time, the excessive call for ventricular work begins to induce fatigue of the myocardium, evidenced by shortness of breath, precordial distress, cyanosis, alternating pulse, and even dropsy. Such phenomena are specially liable to occur in elderly persons, and they have a doubly ominous significance: in the first place, they discover myocardial shortcomings that were not previously known to exist; and, further, each attack throws a fresh overstrain on a ventricular wall which is already taxed to its utmost by the ordinary calls of life, and thus aggravates its inadequacy. Other things being equal, a fast tachycardia is more exhausting to the ventricular contractility than a relatively slow one; Wenckebach considers that there is a 'critical speed' of 180 per minute, at which the ventricular systole of one cardiac cycle coincides with the auricular systole of the next cycle, producing what he calls 'obstipatio sanguinis'. It should be added that patients do not die during attacks, though the foregoing remarks will suffice to impress the gravity of the overstrain thrown by a prolonged bout of tachycardia on a heart that is already seriously diseased.

To sum up what has been said as to the general outlook in paroxysmal tachycardia: it is of grave import in proportion to the amount of ventricular weakness which it reveals or induces. This answers the first question put by patients suffering from this trouble, as to its significance in regard to life prospects.

But they are also, and not unnaturally, concerned to know how far they are to expect relief from the acute discomfort of mind and body occasioned by each attack. To this question it is extremely difficult to give a satisfactory reply. Each case appears to have its own remedies, and it is impossible to prophesy success from the use of any single one of them. On the other hand, no case ought to be regarded as incurable: even where it is an accompaniment of grave organic lesions, this type of irregularity may disappear completely. Neither is prolonged duration to be accepted as evidence of incurability; cases of years' duration have been known to clear up entirely.

Other types of tachycardial paroxysm—those which constitute varieties of auricular flutter and fibrillation respectively—will be considered under those headings.

Auricular Flutter.—This is a tachycardia, usually paroxysmal, or at least periodic, arising in the auricle, which beats regularly but at a great rate. Sometimes all these fast beats come through to the ventricle, but more often they—or rather a proportion of them—are blocked in transit, so that the ventricular rate is one-half, one-third, or one-quarter of the auricular. Its significance lies in the fact that it is usually, if not always, due to organic changes in the auricular walls. Some writers have spoken of it as the intermediate stage in a downward alteration of the auricular functions—intermediate between single or occasional premature beats on the one hand, and fully-developed auricular fibrillation on the other. Certainly it is apt to pass over, either for the time or permanently, into the latter more severe and dangerous form of arrhythmia; curiously enough, the effect of digitalis may be first to effect this transformation and then to convert the irregular pulse of fibrillation to the normal once more.

Totally Irregular Pulse—Auricular Fibrillation.—We come next to the consideration of the totally irregular pulse—the most consistently organic of the recognized types of arrhythmia. It is now recognized universally that this disturbance of action arises in a phenomenon known as auricular fibrillation (Lewis), consisting of replacement of the orderly auricular systole by a disordered tremulous movement of the whole auricular musculature. The result is that an absolutely irregular stream of stimuli is rained down by the fibrillating auricle into the ventricle. Clinically this makes itself apparent in an irregular pulse—not merely an occasional disturbance of an otherwise normal rhythm, but a total absence of rhythm of any kind. Added to this, the usual evidences of auricular contraction disappear from the graphic records and from the other physical signs.

When this rhythm first makes its appearance in a case of heart disease (nearly always either post-rheumatic or cardiosclerotic) it means that the wall of the auricle has reached a certain stage in its downward career. The forces that are tampering with its food-supply have carried their nefarious designs to a definite point of success. The first prognostic fact in relation to the totally irregular pulse is therefore this, that it is an unmistakable mark of auricular degeneration. Even where this disorder first makes its appearance in transitory attacks between which the rhythm returns to the normal, it is sure to become permanent sooner or later. Ninety-nine times out of a hundred, then (for it seems that there are rare exceptions), total arrhythmia spells grave organic disease.

The next question to be answered is the expectation of life after this disturbance has appeared. As to this, there is a difficulty which may be best illustrated by contrasting two cases that came under the writer's observation. At one end of the scale was the case of an elderly man with cardiosclerotic and alcoholic degeneration of the myocardium, who died only twelve days after the pulse had become totally irregular. At the other end comes a man with mitral stenosis, with auricular fibrillation, which did not prevent him from keeping on at his rather laborious work in a tan-yard for at least ten years after its inception. The explanation of this discrepancy is to be found in the fact that the ventricle, and not the auricle, is the vital part of the heart. The danger of the totally irregular pulse is probably twofold: in the first place, the rapid, irregular stream of stimuli pouring down on the ventricle from the auricle imposes a great strain on the former; and secondly, if the auricle is out of action, this adds somewhat to that venous stasis which does so profound an injury to the nutrition of the myocardium (among other tissues), and thus assists materially in precipitating cardiac downfall. It is the first of these factors that is the more immediately dangerous; and in any case it is the condition of the ventricular wall on which depends the ultimate fate of the heart, as to whether it shall continue to work effectively or not. The two cases mentioned above bring out this point very strongly; in the first, alcohol and senility had already reduced the ventricular myocardium to the verge of bankruptcy, so that the onset of an irregular pulse proved to be the last straw. In the other, the active phase of the rheumatic infection was long past, and, as is often the case under such circumstances, the ventricle was almost well again, so that it was able to carry on the circulation, though exposed to the additional worry of a rapid and disorderly series of stimuli descending on it from above.

It is the paramount importance of the ventricle that explains the contrast between the behaviour of the cardiosclerotic and the post-rheumatic heart respectively, after total arrhythmia has supervened. In the first of these, the arterial degeneration that has undermined the efficiency of the auricular wall has been equally active in its attack on the

ventricular myocardium; so that when the stage is reached at which the auricular rhythm goes wrong and thus imposes an extra strain on the ventricle, that structure is already barely able to cope with the demands made upon it by the ordinary rate and rhythm of stimulation. In the post-rheumatic type of heart disease, on the other hand, the degenerative changes induced in the cardiac wall by overwork and chronic stasis proceed more quickly in the auricles than in the ventricles, because in every such case there is mitral obstruction, which throws the burden of overstress upon the auricular wall. As a result, the auricle breaks down and fibrillates, while the ventricle still has plenty of work left in it. Consequently the new burden thrown upon it by the disorderly behaviour of the auricle fails to overwhelm it. The dominant importance of ventricular integrity explains the different way in which some cases of mitral stenosis respond to the onset of auricular fibrillation and the total arrhythmia dependent thereon. In some, the rheumatic process that established the valvular deformity, at the same time injured the ventricular myocardium and induced dilatation; for various reasons this is more persistent in some cases than in others, and it is in such that the supervention of the totally irregular rhythm produces its most definite effects so far as this type of cardiac disease is concerned.

So far, then, our conclusion is that in any given case exhibiting the total arrhythmia of auricular fibrillation, the outlook turns on the condition of the ventricle. It remains to translate this into clinical terminology. First, the prognosis is generally better if the underlying disease be post-rheumatic than if it be cardiosclerotic, alcoholic, or syphilitic in origin. Second, bad signs are œdema, anginal pain, and grouped respirations. The more pronounced and easily provoked the dyspnoea, the worse the prognosis. Finally, the extent to which the symptoms improve under the influence of rest and digitalis, measures which meet with quite a remarkable response in some cases and none at all in others, is an important index of probabilities. The pulse should become slower, the output of urine should increase, and the subjective symptoms should be definitely mitigated, within a few days—a week at the outside—of the institution of such treatment. If this improvement is not manifest, it means that the patient is incapable of receiving benefit from any form of help; and the gravity of the prognosis is directly proportional to this insensibility to appropriate therapeutics.

To sum up: the appearance of total arrhythmia in any case of heart disease adds to the gravity of the prognosis. In any given case the future depends upon the efficiency or otherwise of the ventricle, and on the response to treatment.

Heart-block.—Here the prognosis is necessarily grave. This is not to say that it is an irrecoverable phase of heart disease. In many cases of extreme heart-block the unexpected has happened; the normal rhythm has been restored; but the general rule is that heart-block depends on gross organic disease involving central and vital portions of the myocardium.

The risk of sudden asystole is considerable where there are the syncopal or epileptiform attacks which, when they coincide with the long pulse pauses of heart-block, constitute the Stokes-Adams syndrome. Patients who suffer in this way may go out quite abruptly, being found dead in bed or the like; or they may be quickly exhausted by a rapid series of such attacks occurring at brief intervals. In milder cases, where only every fourth, third, or even second beat drops out, the prospect of sudden death from block and syncope is remote, provided the patient is willing and able to restrict his activities within the limits allowed him by his cardiac lesion.

In any individual case of heart-block there are four considerations upon which the prognosis rests. The nature of the lesion causing the block is the first of these. Acute heart-block—i.e., injury to conductivity by an infective lesion of the myocardium—is usually slight and transitory; it does not appear greatly to pervert the course of the disease from that which it would have followed if no heart-block had occurred. In ulcerative endocarditis, however, the supervention of heart-block may be a serious feature; it may indicate direct extension of a burrowing ulceration into the auriculo-ventricular connections.

Chronic heart-block is much more often encountered than that due to acute lesions. Its commonest causes are arteriosclerosis and syphilis. Of these two, the latter gives the best chance of recovery, since it is amenable to specific treatment. Even so, however,

cure is only effected in a few cases. The arteriosclerotic cases tend to get worse, slowly as a rule, sometimes rapidly.

This introduces two other points of importance—the degree of block present, and the course which it follows under observation. It is pretty obvious that the advanced degrees of block are more to be feared than comparatively mild phases; but in estimating the bearing which the point has on the prognosis, it is essential to take into consideration the progress or otherwise of the interruption of conductivity. This is best illustrated by comparing two cases recently under the writer's care. The first patient was an old lady with pronounced arterial degeneration. Her illness began with occasional attacks of block; but within a week it was practically continuous, and in ten days from the onset she was dead. The other patient, an elderly man of placid temperament, lived comfortably for nearly twenty years after the onset of bradycardia with fainting attacks. Although for the latter half of this period his heart-block was complete, he was little the worse for it so long as he refrained from physical or mental stress until a short time before the end of his life. This comparison affords a vivid illustration of the fact that a severe but stationary degree of block is less minatory than a mild but progressive case.

One more point will arise for consideration in any given case—the other signs of cardiac disease. So far as the likelihood of a fatal issue is concerned, a bad prognosis is of course inevitable when there are signs of impaired contractility in addition to the evidences of interrupted conduction; in such a case it is obvious that the block may be of minor importance, the outlook depending more directly on the state of the other myocardial functions. If, however, we are essaying a forecast of the course that the block itself will follow, then the general condition of the heart makes rather less difference, except that gross enfeeblement of contractile power tends to accelerate the destruction of the conducting function. As for the possibility of lessening block by treatment, apart from the syphilitic type of case spoken of above, nothing has any direct effect as a rule.

Alternating Pulse.—One other aberration of the pulse is generally included in descriptions of arrhythmia, the alternating pulse. This term should include nothing except the alternation of weak and strong beats of the same length. When this is encountered, it is always a sign of advanced or advancing exhaustion of contractility—*par excellence* the vital function of the myocardium. It is therefore an ominous feature of any case of heart disease. Of a series of cases exhibiting this kind of pulse analyzed by P. D. White, three-quarters died within three years of its onset. It is true that in some cases its first appearances are transitory; it may be detected during a bout of paroxysmal tachycardia, or for a few beats following an extrasystole; even so, it is to be received as a forewarning of further troubles to come, and even where it is unsupported by other evidence of myocardial deterioration, it forms sufficient reason, of itself, for warning the patient that his activities must be restricted in future.

Summary.—The aim of this article has been to show that in any case marked by irregularity of the pulse, this symptom should always be analyzed so that its exact mode of origin may be determined; and further, it should always be considered in conjunction with the other means of examining the heart. Nothing is more wildly inaccurate than prognosis founded on the degree of arrhythmia without scientific exploration of its origin.

Carey F. Coombs.

PURPURA.—Purpura is to be regarded as a symptom rather than a disease. It appears to depend upon a defect in the small vessels, probably the veins. In many instances it is a mere incident in the course of a disease, and such cases need not be discussed here.

The following special varieties may be recognized: (1) *P. simplex*; (2) *P. hæmorrhagica*; (3) *Schönlein's purpura* (peliosis rheumatica); (4) *Henoch's purpura*.

Statistics regarding cases of purpura give little help in regard to prognosis, since the severity of the different types varies greatly. It may be noted, however, that Mackenzie found the mortality in a series of 200 consecutive cases to be 14 per cent.

As a general statement, it may be said that the severity of purpura increases with advancing years. In purpuric subjects, attacks are liable to become more frequent, and the resulting anæmia is more severe.

1. Purpura Simplex.—This is a mild form usually seen in children. The hæmorrhages are seldom larger than petechiæ, and in most cases are confined to the limbs.

Prognosis is favourable. Successive crops of spots may appear for three or four days, but as a rule the patient is well within a fortnight, although the pigmented spots may be seen for some weeks. The associated symptoms, such as fever or diarrhoea, never give rise to serious trouble.

In a few instances an attack of purpura simplex has been followed by symptoms of purpura hæmorrhagica.

Cases have been reported in which the purpuric spots were followed by gangrene. Some of these are to be explained by the administration of salicylates or iodides. Apart from such causes they are extremely rare.

2. Purpura Hæmorrhagica.—This is the most formidable type of purpura. Prognosis may be the more serious from the fact that it usually affects children already in delicate health, although it also attacks adults. The purpuric spots appear and soon increase in number and in size.

Epistaxis, bleeding from the gums, hæmatemesis, hæmaturia, and, less commonly, hæmoptysis may occur. The patient becomes profoundly anæmic with great rapidity. In a week the corpuscles may have fallen to 50 per cent. Cases of *purpura fulminans*, occurring especially in children, may be fatal within twenty-four hours; in some of these the end comes before there has been any obvious bleeding from the mucous membranes.

Cerebral hæmorrhage, kidney disease, hæmorrhage into the suprarenals, and heart failure or exhaustion from repeated bleedings, may also lead to a fatal result.

In favourable cases, symptoms cease or lessen in from one to two weeks. There is always a prolonged period of convalescence. Patients are weak and emaciated, and several months may elapse before the blood regains its normal condition. While we must regard prognosis in purpura hæmorrhagica as somewhat grave, perhaps the most striking thing about it is the large proportion of very severe cases which recover.

A very important prognostic factor is the prompt availability of blood for transfusion, which is generally successful in controlling the hæmorrhage. Regard must be paid to the appropriate blood group. (*See* PERNICIOUS ANÆMIA.)

The chief points on which we can base a prognosis are as follows: The more severe and frequent the cutaneous hæmorrhages, the more serious is the case. Hæmorrhages from the mucous membranes, if at all severe, add to the gravity of the condition; of these, epistaxis has probably the least serious significance. Hæmorrhage from many mucous membranes is more serious than from one. Marked pyrexia, albuminuria, constitutional disturbance, and mental depression are unfavourable signs. Accurate information regarding the effect and progress of the hæmorrhages is to be obtained by a frequent use of the hæmocytometer and hæmoglobinometer.

An intermediate group of cases is that in which special symptoms associated with the hæmorrhages arise. These include the occurrence of blebs, ulcers, or necrosis as the result of the cutaneous hæmorrhages; hæmorrhages into the tongue may give rise to great swelling and tension, and may even call for relief by incision; recurring epistaxis may persist after other symptoms have been arrested.

3. Schönlein's Purpura (Peliosis Rheumatica).—This variety is associated with pain and swelling in the joints, urticarial and inflammatory lesions of the skin, and a variable degree of fever. The outcome is usually quite favourable. Fatal cases have occurred, but with great rarity. It is, however, associated with a very large number of possible complications, and recurrence of the disease is exceedingly common. The symptoms of an attack may be very persistent; recurring crops of petechiæ and attacks of fever and arthritis may persist for over a year.

A very potent factor in determining relapses is exertion, and it may be stated here that rest in bed is the one therapeutic measure of outstanding importance in all forms of purpura. Pharyngitis, sometimes so severe as to lead to gangrene of the tonsils and uvula, may occur. The other complications are those usually associated with rheumatism; endocarditis, pericarditis, pleurisy, albuminuria, chorea, and hyperpyrexia may supervene.

It should be remembered, however, that in spite of the somewhat formidable list of possible contingencies, their actual occurrence is so rare that peliosis rheumatica in the average case may be regarded as a benign affection.

4. Henoch's Purpura.—This variety is associated with vomiting, colic, and diarrhœa. A considerable number of cases associated with intussusception are on record. There are joint swellings, and cutaneous affections such as erythema may accompany the purpura. Actual hæmorrhages from mucous membranes may occur.

Prognosis is fairly good, but a fatal outcome may take place. Osler recorded 3 deaths in a series of 11 cases. In one the fatal outcome was the result of an intense hæmorrhagic nephritis.

Hæmorrhage from mucous membranes, nephritis, and exhaustion are the chief dangers, in the absence of any association with a grave abdominal condition. When intussusception is present, it dominates the position as regards prognosis, but it is, of course, more dangerous because of the purpura.

Relapses are a common feature, and attacks of Henoch's purpura may recur for years.

G. L. Gulland.
A. Goodall.

PYELOCYSTITIS.—Pyelocystitis includes a number of conditions differing in gravity, and therefore varying in prognosis. The infection is most commonly due to the *B. coli communis*, which is usually present in pure culture.

B. coli pyelocystitis is acute or chronic; and it may be uncomplicated or complicated. In acute uncomplicated *B. coli* pyelocystitis the infection has occurred in a previously healthy urinary tract. The origin may be traced to hæmorrhoids, acute or chronic colitis, appendicitis, chronic constipation, dysentery, or some other intestinal trouble, or there may be no apparent cause. The attack may be moderate or severe. It is usually possible during the first two days to form an estimate of its probable severity.

In a moderate attack the temperature may rise to 101° or 102°, and is ushered in by a slight shivering or a feeling of chilliness. The bladder symptoms may be severe and distressing. Kidney symptoms are less prominent, amounting to slight pain and tenderness, but no enlargement of the organ; they may be entirely absent.

In a severe attack the initial rigor is also severe, and may be repeated; the temperature rises to 102° or 104°, or even to 105°, and the patient shows evidence of profound toxæmia. There is severe pain in the kidney, the abdominal muscles are rigid, the kidney region is tender, and the kidney, if it can be felt, is enlarged.

A mild attack such as has been sketched above may be expected to last for ten or fourteen days. There is no danger to life, and the principal points in the prognosis are: that relapses are very frequent if the patient is allowed to get up or to go out too soon; and that it is impossible to say, even in a mild attack of pyelocystitis, whether a bacilluria may not persist and give rise to future trouble.

In a severe attack there is danger to life. If the patient is old, or very stout, or bronchitic, or otherwise incapable of withstanding a severe toxæmia, he will probably succumb after a week or ten days. On the other hand, when the patient suffers from no such complication, the immediate prognosis is more favourable. The temperature remains high for about a week, but after that time should commence to fall, and at the end of ten or fourteen days from the onset of the illness will have reached normal. If the temperature remains high and the symptoms show no sign of abating at the end of a week, the outlook is less favourable, and will, if no improvement occurs in the next three or four days, become grave. After one or more of such relapses, the patient usually succumbs. Operation in such cases should not be too long delayed. If at the end of a week the acute symptoms persist, and the patient is beginning to lose ground, operation should be performed.

The results of nephrotomy are not very satisfactory. In 20 cases of nephrotomy for acute pyelonephritis there were 7 deaths (35 per cent). In surviving cases the late results are also unsatisfactory: the acute symptoms subside, but chronic pyelonephritis persists, and nephrectomy may be required at a later date.

The best results in acute cases have been obtained by nephrectomy, after ascertaining that the second kidney is healthy. In 17 cases of nephrectomy there were no deaths.

Where the acute symptoms subside without operation, the infection in some cases disappears. In a large number of cases, however, it persists in a mild form, the principal symptoms being those of slight chronic cystitis. In such cases there is a constant danger of recurrence—which takes place sometimes after short intervals, and sometimes after

some years. Secondary stone-formation in the renal pelvis or in the bladder is not uncommon in such cases, and there is a danger of ascending pyelonephritis of the healthy kidney, leading to suppression of urine and death. Some cases go on for many years without any change, but the patient suffers chronic ill health, and is unfit for great or prolonged efforts, either physical or mental. In some of these cases the original focus of infection, such as chronic intestinal stasis, produces a chronic toxæmia, to which that from the kidney is added. In other cases the kidney is the principal or only source of the toxæmia. Nephrectomy is the only effective treatment in the latter class, and is frequently a difficult and dangerous operation.

In some cases of chronic pyelocystitis the principal focus of infection lies in the prostate. In such cases the symptoms are principally those of cystitis; the pyelitis passes off after a slight preliminary attack, or persists in a mild form. Recovery depends upon successful treatment of the chronic prostatitis. The prognosis for ultimate recovery is somewhat better in these cases, but in some the condition persists in spite of vigorous and prolonged treatment.

Chronic pyelocystitis may be complicated by stone in the kidney or bladder, by movable kidney, diverticulum of the bladder, stricture, or enlarged prostate, or by bladder growths. Prognosis in such cases depends upon the possibility of removal of the stone or other complicating disease. Until this is done the pyelocystitis cannot be cured. Two special forms of *B. coli* pyelocystitis may be mentioned. The pyelitis of infancy and childhood is a frequent form. It occurs in infants a few months old and in young children, and takes an acute course. The condition occasionally ends fatally, but recovery takes place in the great majority of cases, even when a very high temperature is recorded, and profound toxæmia, even coma, is present. The cases improve rapidly under treatment; the temperature falls, and the symptoms subside in a week or ten days. The pus may remain for several weeks, and the bacteria for longer, but eventually these also disappear.

Pyelonephritis is a not infrequent complication of the early months of pregnancy, arising usually in a previously healthy urinary tract, but occasionally as an exacerbation of a chronic pyelocystitis. Premature labour occurs in 25 per cent of severe cases. When the acute attack occurs early in pregnancy, and there is an interval of normal temperature before parturition takes place, the puerperium is usually apyretic. If, however, the acute attack occurs late in pregnancy, there is usually fever during the puerperium; but puerperal infection does not occur.

If the pregnancy be interrupted, the child is usually ill-nourished, and dies in one-third of the cases. If the attack occur late, and the pregnancy go on to full term, the child is usually healthy and well nourished.

The production of abortion, or the induction of premature labour, is seldom necessary, but it may be called for in a severe case. After parturition, the pyelonephritis may subside, and the urine may clear and become sterile; but more frequently bacilluria and some degree of pyelonephritis persist, and exacerbation occurs during succeeding pregnancies.

J. W. Thomson Walker.

PYELONEPHRITIS.—(See PYELOCYSTITIS; PYONEPHROSIS.)

PYLORUS, CONGENITAL STENOSIS OF. (See also STOMACH, SURGICAL AFFECTIONS OF.)—Although not very common, a great deal has been written about this ailment during the past few years. The large proportion of cases recognized in the first-born infants of medical men makes it probable that a number of deaths occur in other children without a diagnosis. The hall-mark of the condition is the association of forcible vomiting with constipation, palpable pyloric tumour, and visible gastric peristalsis. The symptoms usually come on at the age of about four weeks, and apart from treatment are fatal in a few weeks.

It is still hotly debated whether the treatment ought to be surgical in all cases, or only in some. Scudder, for instance, denies that any cures have ever been effected by medical means, and urges operation in every case.

Results of Medical Treatment.—Medical treatment includes lavage, careful feeding by the best modern methods (including breast-milk, peptonized milk, albumen-water,

or citrated milk, all in small quantities), and perhaps a little tincture of opium. Drastic dosing with atropine is advised by Haas. There is no doubt that many cases have recovered under such treatment. The proportion varies in different statistics; it is probably less than half the total number. Voelcker has treated 33 cases, none of which were operated on, with a death-rate of 60 per cent. Monier's figures give 80 to 90 per cent of fatalities under medical treatment. In some of the alleged medical cures the diagnosis has not been indisputably established. There may be very similar symptoms from a form of dyspepsia, without a palpable pyloric tumour, and some of the more readily relieved cases belong properly to this group. Quite recently Thomson has reported a series of 61 cases at Edinburgh treated medically; of these, 7 died within a day or two of admission. Excluding these, 26 recovered and 28 died (=52 per cent). But it is definitely stated that some were of a very mild type, and they did not all show visible peristalsis and a tumour.

In any individual case, the prognosis depends upon the following factors. Children of 8 lb. do better than those of 6 lb. Diarrhœa is very ominous. Head-retraction and fever may be seen just before death. Large vomits are apt to induce fatal collapse. If the weight continues to fall and the vomiting persists after one or two weeks of careful medical treatment, it is not likely that the child will live, apart from operation.

The *x* rays give valuable help. If 70 to 80 per cent of the barium gets through the pylorus in four hours, the patient will probably recover under medical treatment, even if a tumour is palpable. If less than 70 per cent passes through, operation is indicated (Downes, Strauss).

It must be remembered that the small intestine is thin and atrophic, and any attempt to 'feed up' the child, before or after operation, will probably induce fatal diarrhœa. It improves the outlook, however, for two days before operation to wash out the stomach, and give subcutaneous saline containing 2 per cent glucose. Tyrrell Gray reports that this lowers the mortality 20 or 30 per cent.

In favourable cases treatment takes six to twelve weeks. The tumour is probably permanent: in cases described by Batten and many others, the persistence of the hypertrophy was verified by autopsy long after more or less perfect cure of the symptoms.

There is some tendency to relapse in later life; Scudder quotes a number of authorities to this effect.

Results of Surgical Treatment.—From 1898 to 1905 the results of surgical treatment were not good, but probably better than those obtained by medical means. According to Scudder, the mortality of operation was 46·5 per cent.

Operation		Cases	Cured	Died	Died
					per cent
Older Methods	Pylorotomy - -	1	0	1	100
	Divulsion - -	17	8	9	53
	Pyloroplasty - -	12	6	6	50
	Gastro-enterostomy	59	29	30	51
Total - - -		89	43	46	51
Rammstedt Method	Tyrrell Gray - -	48	18	20	
	Kerley - - -	26	22	4	
	Grulee - - -	17	14	3	
	Hill - - -	11	10	1	
	Allen - - -	8	6	2	
	Thomson - - -	5	4	1	
	Ramsay - - -	10	5	5	
Total - - -		115	79	36	31

Since 1905, three short series have been published by Scudder showing much better results. These include, first, 10 cases operated on by several surgeons on the Pacific

coast, and recorded by Stillman; second, a group of 9 in the practice of Richter, of Chicago; and third, Scudder's own series of 17 operations. These combined give a record of 36 cases, with only 5 deaths—that is, a mortality of 13·8 per cent. These American cases were treated by gastrojejunostomy. Scudder's patients have been followed for periods varying from one to eight years (all over two years with a single exception). All but three were under eight weeks old at the time of the operation.

Figures collected from the literature by Thomson, given in the table above, show the relative mortality of the older operations, all much about the same.

The introduction of the Rammstedt technique has changed the whole outlook. By this method the pyloric muscular ring is divided, but the mucosa left uncut. At Great Ormond Street Hospital, until 1918, there had been no cures by any operation for congenital pyloric stenosis; since then, 18 out of 38 operated on by Rammstedt's method have recovered (Tyrrell Gray). Kerley reports 26 cases similarly treated, with only 4 deaths; all but one had a palpable pyloric tumour, and all had visible peristalsis. The earliest age was three weeks; the lowest weight 4 lb. Medical treatment was not given a preliminary trial. Grulee records 17 operations with 3 deaths; Hill, 11 operations with 1 death; Allen, 8 operations with 2 deaths. Downes, quoted by Holt, had a mortality of 43 per cent in 28 gastrojejunostomies, and of 24 per cent in 67 Rammstedt's operations. By this method we may conclude therefore that 75 to 80 per cent of the patients can be saved if there is no undue delay in resorting to surgery.

A good deal depends on a proper technique and on careful after-treatment. It is very important to use a small incision, waste no time, divide the pyloric muscle by blunt dissection so as not to wound the duodenum, and see that the mucosa bulges freely through the gap in the muscle. Tyrrell Gray attaches great importance to gas-oxygen as the anæsthetic.

With reference to the prognosis in individual cases, when the vomiting is only twice a day, breast-feeding is available, and there is no marked wasting and no loss of weight during a week of treatment, the probabilities are that medical treatment will be successful. If the weight has fallen to 6 lb. and is still falling, vomiting is frequent, and there is no fæcal matter in the stools, it is fatal to delay; immediate operation is indicated whether the pylorus is palpable or not. Diarrhœa, after operation, is a grave omen. Hyperpyrexia, according to Tyrrell Gray, is not a dangerous sign.

Apparently the operation does not lead to any reduction in the mass of the pyloric muscle. A baby operated on by Murphy recovered well from the operation, but died six and a half months later from causes unconnected with the gastric trouble: the tumour of the pylorus persisted unchanged. Scudder states that in nine cases after a gastrojejunostomy in these infants, bismuth skiagraphy showed that the food passed through the stoma and not through the pylorus: it is well known that the food passes only through the normal passage and not by the stoma after a short-circuiting operation in patients or animals with no pyloric obstruction; evidently, therefore, the mechanical obstruction of the circular muscle persists.

After successful operation, the children grow up into normal individuals. A very sturdy boy, age six, on whom gastrojejunostomy was performed in his second month, is known to the writer.

To summarize, we may conclude on the evidence before us that medical treatment in typical cases will save certainly less than half the patients, perhaps so few as 10 per cent, and that the survivors may suffer from persistent symptoms of pyloric obstruction; that the operation mortality is 25 per cent, but may be 50 per cent if medical treatment has been persisted in before the surgeon is called; and that neither medical nor surgical treatment leads to any improvement in the pyloric hypertrophy.

REFERENCES.—Miller, *Medical Diseases of Children*, 1911, 260; Paterson, *Lancet*, 1906, i, 577; Scudder, *Ann. of Surg.* 1914, lix, 239; Voelcker, *Lancet*, 1919, i, 380; Thomson, *Surg. Gynecol. and Obst.* 1906, iii, 521; Kedley, *Jour. Amer. Med. Assoc.* 1919, lxxii, 16; Grulee, *Cleveland Med. Jour.* 1917, xvi, 387; Holt, *Brit. Jour. Child. Dis.* 1917, July, 161; Hill, *Jour. Missouri Med. Assoc.* 1919, xvi, 379; Allen, *Ann. of Surg.* 1919, May, 531; Downes, *Jour. Amer. Med. Assoc.* 1914, lxii, 2019; *Surg. Gynecol. and Obst.* 1916, March, 251; Thomson, *Edinburgh Med. Jour.* 1921; Ramsay, *Brit. Jour. Surg.* 1921, 397; Tyrrell Gray and Reynolds, *Brit. Med. Jour.* 1921, ii, 891.

A. Rendle Short.

PYONEPHROSIS.—There are two types of pyonephrosis, and the prognosis is different in each. The first type is pyonephrosis secondary to uronephrosis (hydronephrosis), or uropyonephrosis; the second is pyonephrosis developing from acute pyelonephritis.

In uropyonephrosis the condition is unilateral, and the actual obstruction is situated high up in the ureter, being due to a stricture, stone, or duplication of the ureter. The superadded infection is usually hæmatogenous.

Pyonephrosis developing in pyelonephritis occurs especially in cases of old-standing disease of the lower urinary organs, such as stricture, chronic prostatitis, enlarged prostate, growths of the bladder, etc. There is frequently bilateral disease, but the second kidney is not necessarily pyonephrotic.

The general symptoms of uropyonephrosis are often moderate, although in some cases the character of the illness resembles that of the other form of pyonephrosis.

In pyonephrosis due to pyelonephritis the patient is seriously ill, with a high swinging temperature and other symptoms of toxæmia. Unrelieved pyonephrosis may lead to a fatal result in ten or fourteen days; or the course may be more prolonged, and the pus find its way through the wall of the sac and form a perinephritic abscess, death taking place from exhaustion after some weeks.

The prognosis depends upon the patient obtaining prompt relief by operation, and upon the presence or absence of infection of the bladder and of the second kidney. In a few cases where a mild infection of a hydronephrotic sac has occurred, it is possible to do a plastic operation for removal of the obstruction, and what remains of the kidney is saved. In the majority, however, the choice lies between nephrotomy and nephrectomy.

Nephrotomy can be performed in the very worst cases when the patient is weak from prolonged suppuration, and in cases where it is impossible to estimate the value of the remaining kidney, or when this organ is known to be the seat of advanced disease. The mortality of this operation is from 17 (Küster) to 23 per cent (Tuffier). After the operation an improvement in the work of the second kidney is usually observed, and the general health greatly improves. In 27 per cent of cases the sac shrinks and the patient is cured.

In a certain number of cases septicæmia persists, and the work of the second kidney is still poorly performed. This is due to continued suppuration in the thick fibrous-walled cavity, to undrained pouches, to abscesses in the walls and partitions, to stones being left in the sac (16 per cent of cases), or to the persistence of the ureteric block. A fistula remains in from 45·6 per cent (calculous pyonephrosis 34·2 per cent, non-calculous pyonephrosis 57·1 per cent) to 56 per cent (Küster).

Secondary nephrectomy is indicated when septicæmia persists; when it is believed, from the inadequate secretion of the diseased kidney and the absence of disease in the second kidney, that a depressed renal function in the latter will improve after nephrectomy; and when the patient is gradually losing ground from prolonged suppuration. The mortality of secondary nephrectomy is only 5·9 per cent. If this be added to the mortality of nephrotomy (23·3 per cent), the total mortality of nephrotomy followed by nephrectomy at a later date is 29·2 per cent.

Primary nephrectomy should be performed when it is certain, from examination of the urine of the second kidney, that the function of this organ is adequate. The mortality of this operation is 17 per cent.

The prognosis after nephrectomy, in cases where the second kidney and the bladder are healthy, is very good, and there is no reason to expect that the duration of life will be shortened. On the other hand, in cases where there is chronic cystitis which does not clear up after nephrectomy, and especially where the second kidney is already infected, the danger of acute pyelonephritis of the remaining kidney, with suppression of urine, is very considerable. Even if this take place, however, the outlook is not hopeless. The writer has performed nephrotomy on the solitary kidney in such a case, and the patient is known to be alive and in fair health several years after. *J. W. Thomson Walker.*

RECTAL PROLAPSE.—In young children, the great majority of cases of prolapse of the bowel get well in the course of a few months with simple treatment (replacement, purgatives, astringent lotions, etc.). It is not possible to quote exact statistics. It is only in a few instances that any operation is required.

In adults, on the other hand, there is little tendency to amendment, and operation will be necessary. Melted paraffin injection is going out of fashion ; although it may be immediately successful, cases of ischio-rectal abscess have been recorded at a long interval afterwards. When only the mucous coat prolapses, searing it to the muscle with the cautery is very successful, but in adults it is generally the whole thickness of the rectal wall that comes down, and this treatment is not suitable. Excision of the prolapse may then be considered. According to Binnie, this is dangerous on account of the fact that the peritoneum is likely to be opened. He quotes a 10 per cent mortality, and says that 7 per cent relapse. Mummery incises between the rectum and coccyx, and stuffs in gauze ; he relates 4 successful cases. In a few rare cases colopexy is necessary ; this is well spoken of ; no doubt failure is rare, but the writer has seen a case.

Sometimes a rectal prolapse may become irreducible and even gangrenous, and, apart from operation, may end fatally. I was once called to see such a case in an insane baronet, who steadfastly refused treatment and died in about a week. *A. Rendle Short.*

RECTUM, CANCER OF.—Prognosis in carcinoma of the rectum largely depends on the stage at which the disease is detected. In this connection it is impossible to insist too strongly upon the importance of a digital examination of the rectum in every patient, whatever his age, presenting rectal symptoms. It must be borne in mind that rectal cancer may occasionally occur as early as the second decade of life. A cylindrical-celled carcinoma of the rectum has been reported in a girl of eleven, the youngest case of carcinoma on record.

Cancer of the rectum begins upon one aspect of the bowel wall as a small ulcer, which spreads circularly along and across the bowel. As it spreads it puckers up and contracts the affected area of mucosa, and thus strictures the bowel. Accordingly intestinal obstruction or perforation is the usual cause of death in untreated cancer of the rectum. Even when a well-defined stricture has formed, a bridge of normal mucosa can still be detected forming part of the circumference of the stricture, and the breadth of this bridge gives some idea of the stage which the cancerous ulcer has reached. Even more important is it to determine whether the growth has passed outside the walls of the rectum. If the growth is fixed to its surroundings, this is probably the case. The vertical extent of the growth in the axis of the rectum is a less important point. It used to be considered that a rectal growth was only operable if the examining finger could pass through the stricture and feel normal mucosa above. With modern methods, extension of the growth along the bowel for a considerable distance is not in itself a bar to operation.

It must be remembered that methods of estimating the operability of a growth from local examination only are open to fallacy. In certain cases, while the primary growth is still small and mobile, metastases may form in the liver, probably owing to cells carried there by the blood-stream. On the other hand, fixation of the growth may result from merely inflammatory changes. A final estimate as to the operability of a rectal carcinoma can only be given when the abdomen has been opened and its interior examined manually. This is one of the advantages which combined abdominoperineal methods of operation possess over other methods. During the past year, in three cases where I opened the abdomen to do a radical operation for an apparently early cancer of the rectum or sigmoid, the detection of nodules in the liver has arrested the operation. It is interesting that in each of these cases the nodules were felt in the *left* lobe of the liver. Whether the rectum is to be excised by the perineal or the abdominoperineal method, an exploration of the abdomen appears to be an essential preliminary.

Since most cases of cancer of the rectum occur in advanced life, the general condition of the patient's health—and more especially the condition of the heart and kidneys—is an important element in the prognosis. Unless their vital organs are fairly sound, patients cannot be expected to tolerate an operation for the extirpation of the growth. On the other hand, apparently delicate patients, if free from organic disease, often stand severe operations well. The worst subjects apart from organic disease are, in my experience, of the stout florid type with soft tissues, especially if alcohol has been habitually taken.

Prognosis as regards Recovery from Radical Operation.—The following table by Tuttle, quoted by Swinford Edwards, gives the mortality of the different methods of operation up to the date of its publication :—

RECTUM, CANCER OF

MORTALITY OF THE VARIOUS OPERATIONS FOR RECTAL CANCER.—(Tuttle.)

Method	Number of cases	Deaths	Mortality per cent
Sacral - -	913	211	23.1
Perineal - -	569	76	13.5
Abdominal - -	49	18	36.7
Combined - -	22	9	40.9

These figures show a high mortality for all methods except the perineal. At the present time they do not afford a correct view of the risk involved in any method of excision. Goullioud published a series of 11 abdominoperineal operations in women without a death, and I have had a sequence of thirteen such operations in both sexes in the Middlesex Hospital without a fatality, including two patients of 64 and 60. Aslett Baldwin performed the operation with success in a woman of 76.

Mr. W. B. Gabriel, Registrar in the cancer department of the Middlesex Hospital, has very kindly looked up the results of my abdominoperineal excisions at the hospital. From 1908 to 1919, excluding 2 cases, both fatal, in which simultaneous hysterectomy was performed, there were 19 cases, of whom 15 recovered, a mortality of 21 per cent. This result, for an operation which confessedly lies near the limit of human endurance, must be regarded as satisfactory.

Unfortunately, in spite of increasing experience and equal care, my recent results at the Middlesex Hospital have not been so good. Up to 1917, I had not lost a case; from 1917 to 1919 I lost 4 cases out of 6, and my subsequent experience has been equally unsatisfactory. I am convinced that the national stamina has been so lowered by the anxieties and privations of war, that the mortality of the operation cannot at present be kept down to a reasonable figure, and of late I have performed it with increasing reluctance.

On account of the immediate danger of the abdominoperineal operation, there has of late been a shift of surgical opinion in favour of a modified perineal operation. Lockhart-Mummery,¹ for instance, now practises a preliminary colostomy, followed by an excision of the rectum from below, with ablation of the anus, and closure of the divided end of the bowel in the depth of the perineal wound by a purse-string. The following is his table of immediate mortality for this operation :—

	No. of cases	No. of deaths
1915 - -	8	1
1916 - -	16	2
1917 - -	17	2
1918 - -	24	0
	<u>65</u>	<u>5</u>

He is not yet able to give results as regards recurrence, but obviously the operation is a safe one. As contrasted with the old perineal operation, it enables the interior of the abdomen to be inspected, it removes the anus and its muscles in which recurrence was so frequent, and it replaces an uncontrolled sacral anus by a convenient colostomy opening through the rectus muscle. It cannot be regarded as an ideal method, because it does not allow of complete removal of the mesorectum and its glands. It is possible, however, that this defect may be remedied by the introduction into the stump of the mesorectum just below the promontory of an efficient tube of radium, say, of 100 mg., left in position for the twenty-four hours subsequent to the operation. With this modification, which it may be hoped would destroy any focus of carcinoma in glands not removed, I think the method is a hopeful one.

Graeme Anderson² has recently suggested, as a means of lessening shock, operation in three stages : (a) Colostomy ; (b) Perineal excision of the rectum and anus with closure of the divided end of the sigmoid ; (c) Removal by laparotomy of the remaining portion of bowel below the colostomy, and excision at the same time of the remaining portion of the mesorectum and the pelvic glands. He has performed this operation in three cases

without a death. It appears to be at the same time complete and safe, though some patients may object to the three anæsthetics it involves.

Mr. W. E. Miles remains a firm advocate of the abdominoperineal method, which he did so much to introduce.

There is now general agreement as to the inadvisability, whatever method be adopted, of retaining the natural faecal outlet at the anus, an end very desirable in itself. But attempts to bring down the upper colon and attach it to the sphincters are very dangerous to life. The mortality of an abdominoperineal excision terminated by bringing down the bowel is at least double that of the same operation terminated by a colostomy. Even if the patient survives the operation, the anal sphincters may subsequently become fibrotic and useless. The danger of recurrence of the growth in the anal structures left behind is also great. In most cases, too, the final result is a sacral anus, owing to the breaking down of part of the line of union of the bowel.

In regard to the remote results of excisions of the rectum performed from below, while some surgeons, notably Mr. Harrison Cripps, have recorded satisfactory results in a considerable number of cases, others, especially Mr. W. Ernest Miles, have experienced recurrence in almost every case. My own experience of these operations accords with that of Mr. Miles. On the other hand, the perineal method has a wider field of applicability. Very stout patients, those with impaired constitutions, and those over seventy, are unsuitable subjects for the abdominoperineal operation. In such cases I have hitherto performed a simple colostomy, even for 'operable' growths, but for these a perineal operation combined with a colostomy and the use of radium in the mesorectum deserves a trial.

Lastly, it must be stated that owing to the great variations in malignancy which rectal carcinoma presents, the most limited operations, if performed early, may occasionally be successful. The mere excision of the ulcer from within the rectum, with a margin of $\frac{1}{4}$ in. of healthy mucosa, is not invariably followed by recurrence.

Prognosis as regards Recurrence after Operation.—The published results of Mr. Ernest Miles show the prognosis of different methods of operation in the hands of the same surgeon. They are a convincing testimony to the superiority of abdominoperineal over perineal operations in those patients who survive the operation.

In his search for the ideal method, Mr. Miles has passed through various stages. He describes how, between 1889 and 1900, he did operations from the perineum, with section of the bowel one inch above the margin of the growth. These operations were followed by recurrence in an average period of twelve months. During 1902 to 1904 he performed fourteen operations with a wider removal of the perineal skin and the ischiorectal fat, the operation otherwise remaining the same. Recurrence took place in every case, and was most common in the levator ani. In a third series of eleven cases, 1904–5, Kraske's method was adopted; the mesorectum and the levatores ani were extirpated, and the bowel was divided three inches above the uppermost limit of the growth. Recurrence took place in every instance, and seven of the recurring growths involved the lower margin of the bowel and the adjacent mesocolon. As Miles remarks, these recurrences probably arose either from pre-existing permeation of the apparently healthy rectal wall, or from metastases in the paracolic lymph nodes—that is to say, the disease returned in tissues situated above the field of operation. He accordingly decided to excise as much of the pelvic colon and its mesocolon as he could reach. After this operation recurrence followed in every case, and in fourteen cases it took place in the pelvic peritoneum and the pelvic mesocolon—tissues which could not be removed by an operation performed entirely from below. Miles accordingly abandoned the perineal method; he had performed it successfully in 58 patients, of whom 55 were known to have suffered from recurrence, a percentage of return of 94·82 per cent. Since abandoning the perineal operation, Miles has developed an abdominoperineal method, which in many details is his own. In his first 42 cases the mortality was 40 per cent. The operation appeared to him unjustifiable after the age of sixty, since no patients who submitted to it beyond that age recovered from it.

Mr. Lockhart-Mummery, in his recent work, quotes the following percentages of three-year cures following the perineal methods of operation: Harrison Cripps 25 per cent, Hochenegg 17·2 per cent, Tuttle 14·8 per cent. These figures were no doubt obtained by a selection of cases far more rigid than is now applied.

Recently Mr. Miles has published his results up to 1920. They show a satisfactory improvement in operation mortality.

OPERATION MORTALITY OF ABDOMINOPERINEAL EXCISION (MILES).

			No. of cases	Mortality
				per cent
First series	-	-	42	40·0
Second „	-	-	19	26·3
Third „	}		11	18·1
(to Nov., 1920)				

Miles ascribes the improvement in his results partly to improved technique and partly to the substitution of spinal anæsthesia with gas and oxygen for chloroform and ether.

Recurrence Mortality.—Miles traced 31 of the cases who survived the operation. Of these 31 cases, 3 died of intercurrent disease and 8 of recurrence. Leaving out of consideration the 17 untraced cases, the recurrence mortality is 28·5 per cent. Cases to be regarded as cures are, 1 case well after eleven years, 1 after ten years, 4 after nine years, 3 after eight years, 3 after seven years, and 4 after six years.

Miles would only perform the abdominoperineal operation in patients able to stand the strain of a severe surgical procedure. For other cases, in his opinion, the choice lies between a colostomy and perineal excision as a palliative measure.

In a personal letter Miles informs me that he has only had 2 post-operative deaths in his last 21 cases, a very satisfactory result.

Grey Turner recorded in November, 1920, the following personal results :—

Table I.—IMMEDIATE RESULTS OF 67 OPERATIONS.

Nature of operation	Cases	Deaths	Cause of death
Local resection - - -	2	0	Sepsis and kidney, pneumonia, shock (2), cardiac attack, sloughing of gut
Perineal excision - - -	4	0	
Sacral excision - - -	47	6	
Abdominal excision - - -	2	1	
Abdominoperineal in one stage	5	3	
Colostomy and sacro-abdominal excision in two stages	7	0	
Totals -	67	10	

Table II.—AFTER-HISTORY OF THE 57 CASES THAT RECOVERED.

Cannot be traced - - - - -	4
Operated upon recently - - - - -	5
Alive, but with recurrent disease - - - - -	2
Known to have died of recurrent disease - - - - -	28
Died without recurrence 13 years after operation - - - - -	1
Alive and well 1 to 17 years after operation - - - - -	17
Total -	57

Table III.—DETAILS OF THE 28 DEATHS FROM RECURRENT DISEASE.

Dissemination recognized at time of operation - - - - -	3
Recurred within one year - - - - -	11
„ between one and two years - - - - -	4
„ „ two and three years - - - - -	4
„ „ three and four years - - - - -	5
„ „ four and five years - - - - -	1
Total -	28

Of the 17 patients alive and well, 2 were local resections, 2 were abdominoperineal, the rest sacral excisions. Some of the patients, years after operation, are following daily laborious occupations with little inconvenience and are in excellent health. Mr. Grey Turner believes that the future lies in earlier diagnosis, which he hopes will permit the performance of operations preserving the normal anal function. He believes that the best operation for most cases is exploratory laparotomy with colotomy, followed by sacral excision.

In the same discussion Sir Gordon Watson gave his mortality from the abdominoperineal operation as 34 per cent. Of 21 recoveries, he knows that 10 are dead, 5 certainly alive. The others have not been traced.

Sir Gordon Watson advocates a 'radical' perineal operation for all cases except growths at the rectosigmoidal junction. He argues thus: If 100 patients undergo the abdominoperineal operation, 66 survive, and one-third of the survivors escape recurrence, an ultimate survival of 22 patients. If 100 patients undergo the perineal operation, 93 survive the operation and one-third of these escape recurrence, an ultimate survival of 31 cases. It is probable, however, that the recurrence rate in the perineal cases will be much higher than Sir Gordon Watson assumes.

Of 47 new cases of rectal carcinoma attending St. Mark's Hospital in 1919, 42 cases were found to be fixed and inoperable, a fact which indicates the necessity of educating the public to seek early advice for rectal symptoms.

Influence of Radium Treatment on Prognosis.—The value of radium in cancer of the rectum is not yet determined, but Wickham and Degrais (1913) state that inoperable cases of cancer of the rectum have certainly found in radium a palliative and useful treatment, that radiation may clear the passage by dissolving the nodules, that the hæmorrhage, discharge, and pain diminish, and that the general condition of the patient consequently improves. In two cases they were able to avert a colostomy, and to prolong a tolerable existence for periods of twelve and fifteen months respectively.

It is obvious that the subject has not yet reached a stage in which general statements are possible, and in any particular case the results of treatment are uncertain. A case of my own shows that radium may convert an inoperable into an operable case. The patient, a man of sixty, was pronounced beyond the range of operation by a well-known surgeon, and was brought to me for a second opinion. I agreed that the case was inoperable, and advised a trial of radium. The treatment was carried out by Dr. N. Finzi. Within a few weeks the edges of the growth became flat and fibrotic, so that it might have been mistaken for a simple stricture; slight mobility could now be detected in it. I then advised and carried out an abdominoperineal radical operation. Two tubes of radium were inserted at the operation into the pelvic cavity, one from below and one from above. The peritoneum forming the floor of the rectovesical pouch was infected, and the operation was here necessarily an incomplete one. Suppuration occurred in the pelvis, and during convalescence a troublesome attack of pyelitis occurred; but at present, eight years later, the patient remains well and free from recurrence.

Cases suitable for Colostomy.—In a very large proportion of the cases unsuitable for radical operation, an immediate colostomy is the proper line of treatment. The operation should not be deferred until obstruction is imminent. As Mr. Swinford Edwards says: "That I would perform a colostomy on every patient upon whom I had decided that a radical operation was inadmissible I will not say, but rather that I would strongly advise the operation as soon as any of the symptoms of the disease became so marked as to interfere with the comfort of the patient". This statement, in my opinion, rather under-estimates the importance of colostomy. The operation is not merely a means of increasing the patient's comfort; it appears to exercise a definite influence in retarding the progress of the disease.

Prognosis after Colostomy.—The prognosis in cases of cancer of the rectum treated by a simple colostomy is much more hopeful than is generally believed.

First, in regard to the question—Is life worth living with a colostomy wound? Upon this point most patients, and some medical men, are apt to take quite unjustifiably gloomy views. Numbers of people with a colostomy opening go about their daily work, and are to all appearance normal individuals. Thus, a well-known police magistrate with this disability sat on the bench for some years; among patients of my own, one is a foreman

at a factory, another a police constable doing full duty, another a dressmaker who made frequent Continental journeys in the course of her business. There are two conditions essential to a successful colostomy: one that the opening shall be well situated (preferably in the midst of the rectus muscle) and properly made, the other that it shall be properly managed by the patient. An injection of soap and water, followed by the use of the bed-pan before rising in the morning, will usually ensure freedom from trouble during the day. Care must also be exercised by the patient in regard to diet, and laxative foods must be taken in strictly regulated quantities.

Lockhart-Mummery investigated the degree of disability produced by a colostomy in 17 of his hospital cases. Of them, 12 had returned to work within a year of the operation, 4 had not, and 1 had been compelled to take a lighter job. Those returning to work included persons in the following occupations: engine-driver on the railway, actor, washerwoman, workshop foreman, drapery assistant, munition worker, physical drill instructor, and stevedore.

Having considered prognosis with regard to comfort, we may turn to the outlook in regard to the symptoms of the growth and its rate of advance. The diversion of the septic stream of fæces from the surface of the ulcer is followed in practically all cases by a diminution or cessation of mucopurulent discharge from its surface. Accordingly, the teasing diarrhoea or rectal tenesmus produced by the irritant discharge diminishes or ceases, especially if the lower bowel is periodically washed out through the colostomy wound with a mild antiseptic such as boracic lotion. There is a corresponding improvement in the bleeding, and, except in very advanced cases, in the sacral pain, for both of these signs are mainly of septic origin. For some years the patient may be able to forget that the growth, though quiescent, is still present. Sooner or later, however, sciatic pains will indicate infiltration around the sacral plexus, and frequency of micturition, with albuminuria and hæmaturia, will indicate invasion of the bladder. Compression of the ureters will be followed by ascending pyelonephritis, which is likely to end the case if in the meantime hepatic metastases do not manifest themselves.

The period of relief from symptoms which follows a colostomy varies widely. It may be estimated at from one to five, or even seven, years. In one case within my knowledge a simple colostomy was followed after some years by complete cicatrization of the growth, spontaneous closure of the colostomy, and re-establishment of the natural anal evacuations—an instance of the natural cure of cancer; it is probable, however, that in this case the disease will ultimately re-assert itself.

While a properly made and managed colostomy wound need give little more trouble than a set of artificial teeth, an ill-made prolapsed one, with colitis of the bowel above and sepsis about the opening, is undoubtedly a misery to which some patients will consider death preferable.

REFERENCES.—¹*Lancet*, 1920, Jan. ; ²*Proc. Roy. Soc. Med. (Proct. Subsection)*.

W. Sampson Handley.

RECTUM, GUNSHOT WOUNDS OF.—(See GUNSHOT WOUNDS.)

RELAPSING FEVER.—The mortality of relapsing fever varies considerably according to the type of the disease. In the European form the mortality was 4 per cent in Western Europe, but 15 per cent in Russia, while Sandwith reported a similar death-rate in Egypt. In the American form it is from 2 to 6 per cent. In India, Vandyke Carter had a mortality of 18 per cent in Bombay, but more recently Choksy gives it at 30·7 per cent in 7131 cases in the same city, while during an outbreak in the United Provinces it was 26·5 per cent. In the Darjeeling hills the mortality is also high. In Indo-China Séguin had a death-rate of 8 per cent, and in Tonquin Vassal one of 48 per cent, showing great variations in places not very far apart. During the war the disease was reported from East Persia and from Mesopotamia with a very low mortality under treatment with arsenical preparations.

According to V. Carter, one-half the deaths occur during the acme of the first paroxysm, and one-fourth more during the first remission. The rest take place later, commonly from complications such as pneumonia, cerebral hæmorrhage, or exhaustion. Deep jaundice is a bad sign, while abortion often results.

In the African form of the disease the attacks are mild in natives, but more severe

in Europeans. According to the Cooks, the death-rate in Uganda is 13·6 per cent, while in recovering cases great prostration remains.

Until recently no specific treatment for the disease was known; but now it is established that such arsenical preparations as salvarsan and galy, in moderate doses intravenously, best given shortly before a crisis, destroy the spirilla and reduce the mortality considerably.

Leonard Rogers.

RENAL AFFECTIONS.—(See KIDNEY; NEPHRITIS.)

RHEUMATIC FEVER.—The prognosis here must depend upon the particular organs that are most affected in the attack. If they are vital ones, such as the heart and brain, and are severely injured, the risk to life is great; but where the articulations chiefly suffer, though there may be great distress, the actual danger to life is but small.

It is a very difficult undertaking in this disease to single out a particular manifestation and lay down rules that apply to it alone, for in the course of the illness we continually find one lesion obscuring the prognosis of another. An analysis of 172 cases of rheumatism in children under twelve years of age illustrates this point very clearly. Of these, 114 had cardiac lesions, 111 arthritic and muscular pains, 104 chorea, 33 subcutaneous nodules, 22 acute tonsillitis, 17 cutaneous manifestations, 6 epistaxis. There still remains, however, a demand for the prognosis of the individual lesions, and the writer will accordingly first consider, under the general term 'rheumatic fever', the prognosis of the articular manifestations.

There is another difficulty in the prognosis of rheumatic fever which is caused by the inadequacy of the name. If we use the term rheumatic fever, we discover that the disease may occur without fever in childhood, and that such a lesion as rheumatic pericarditis may be present with a subnormal temperature; yet in childhood also the term acute rheumatism is often inapplicable, for the onset may be most stealthy. It must be remembered that the most insistent cases in childhood may run a course of some weeks to a fatal end with practically no fever: a point which must influence our views as to the prognostic value of salicylates, even though they reduce fever in rheumatic fever.

The condition most comparable to rheumatism in its general course is tuberculosis, for in both there occur febrile and afebrile attacks, gradual and acute onsets, and all degrees of duration.

Fulminating cases of acute rheumatic arthritis are apparently not so frequent as they used to be. In rheumatism, as in gout, we do not meet with so many of those cases from which have been drawn the pictures of the disease we read in our text-books of twenty-five years ago. As Litten observed, the type of the disease has apparently become more septic in character.

The prognosis in these acute attacks, provided the heart is not damaged, is good, and acute rheumatic arthritis tends to complete recovery.

Since the introduction of salicylates, such cases have been much easier to handle; but when we search for accurate facts upon the exact improvement they have produced in the prognosis, we are baffled. There are several important reasons for this. On the one hand, the frequency of some degree of heart affection is more generally realized, and the knowledge of the behaviour of the disease in childhood is much more definite. On the other hand, with our increasing knowledge, we are getting milder cases under supervision more readily. We have one element, that of cardiac infection, leading us to think that the disease lasts quite as long as heretofore, and the other, the treatment of the milder cases, leading us to think that the duration of the disease is shortened.

It is some forty years since these drugs were first used in this country by Dr. T. J. MacLagan, and in the early eighties careful statistics were made to elucidate the value of such treatment as compared with the alkaline method, or the natural course of the disease. These investigations showed conclusively that pain was rapidly relieved and fever lowered. Dr. Pye Smith found that in 180 out of 355 patients these symptoms were arrested in five days, but in only 3 out of 24 cases treated expectantly was there the same good result.

The influence upon relapses was much disputed; Dr. Pye Smith had 93 relapses in his 355 cases; Dr. Donald Hood found 34 relapses in 850 cases treated without these drugs (4 per cent), and 182 in 1250 cases treated with them (14·6 per cent).

To the writer, it seems that our conception of rheumatism has so changed that it is not possible at the present time to express in statistics the influence of the salicylates. This is clear, that these drugs have no lasting effect upon rheumatic processes, for fresh infections or recrudescences are very frequent in childhood; but acute articular rheumatism is greatly relieved and the pain and distress are much diminished. For these reasons the prognosis is improved.

There are, however, some cases in which the articular symptoms, though less violent, are more intractable, requiring large doses of the salicylates to keep the symptoms under control. It is a matter of opinion as to whether there are cases in which these drugs are ineffectual, but it has been the writer's experience to see some in which, while several of the joints recover completely, others drift into a rheumatoid condition; and believing as he does that there is a rheumatic form of rheumatoid arthritis, he is not prepared to accept the dictum that an arthritis which does not yield to the salicylate treatment is necessarily non-rheumatic. We are here face to face with the great problem of the present time in the treatment and prognosis of rheumatic fever—are the salicylates *specific* antidotes? This much we can assert with regard to the arthritis, that when it does not react to this method of treatment, and yet is of what we call the rheumatic type, the prognosis as to the future is uncertain.

Hyperpyrexia, although less fatal since the introduction of the cold-bath treatment, is still, despite the salicylates, of very uncertain prognosis. In late years it has been a very rare occurrence; the diminution in frequency did not occur at the time of the introduction of salicylate of soda, however, but some years later, and this may mean an alteration in the character of the disease of temporary duration, rather than the possession of any real control of the symptoms.

Mental symptoms may, in adult life, though rarely, add considerably to the gravity of the prognosis of acute rheumatism. Great depression, and even mental derangement, may occur. Unless there is a previous history of mental instability, a gradual recovery may be expected. Another troublesome group of symptoms in the adult are abdominal. These may take the form of dilatation of the stomach or troublesome vomiting and gastralgia, or again of pain located apparently in the large bowel and leading to troublesome distention or obstinate hiccough. Recovery may be much delayed by these complications. Whether rheumatism is a cause of acute appendicitis has not been certainly established, but should this prove to be the case it is clear that the prognosis in such a complication is to be judged by the general indications that govern the prognosis of appendicitis. Where rheumatic fever attacks a patient living in an insanitary house, the character may become almost typhoidal. There is great prostration, and the tongue becomes dry and cracked; the course is long, and troublesome vomiting may prevent the use of the salicylates. Although the eventual recovery may be good, it is slow, and the illness may last for months.

There is little to guide us as to the prognosis of future attacks. Our common sense tells us that if the original attack in an adult is dependent upon some gross exposure to chill and to general carelessness, there is good hope that with proper care in the future the first attack will also be the last.

The writer believes that if there is recurrent tonsillitis with obviously diseased tonsils, their enucleation will improve the outlook. There is, however, no reason for believing that complete removal of the tonsils will prevent future attacks, though this may be the case in some instances. The writer has 17 examples of attacks after this operation, these occurring at intervals from six months to five years after the operations. One proved fatal, 2 developed carditis, 3 chorea and heart disease, and 13 chorea. The operation for enucleation is not always a success in itself.

In general terms, then, the outlook in acute articular rheumatism is good as to life and to complete recovery; but such a general statement is of little value, seeing that in a large number of cases the heart is more or less affected, and that upon the degree of this affection the prognosis in acute rheumatism mainly depends. In children the articular symptoms are of little prognostic importance.

There seems no serious difference in the prognosis dependent upon the variety of salicylate compounds used in the treatment. Those who push these drugs usually combine the sodium salt with sodium bicarbonate, but others claim that the acid aspirin is even

more effectual. In the severe articular forms the writer prefers the salicylate of sodium, finding it less likely to upset the digestion ; but it must be premised that only the purest drugs are used. It is important to remember that in childhood, if these drugs are pushed too heavily and without reference to the particular patient, bad and even fatal results may follow in a case of moderate severity.

As a general guide, it is useful to recognize three classes of arthritic lesions in rheumatic fever :—

1. The acute severe type, recovering rapidly and completely.
2. The relapsing subacute type, also recovering, but more slowly. Such attacks may leave some weakness in the larger joints.
3. The more pernicious type, drifting into the rheumatoid group. This latter, many authorities regard as non-existent.

There may be great muscular wasting in some of these cases of severe rheumatic arthritis ; and in children in whom the hands are badly affected, the result may resemble precisely the rheumatoid arthritis of young adults. Very good recovery may, however, result, though the improvement is generally slow and such cases are not frequent.

The prognosis in the cardiac affections is discussed elsewhere (*see RHEUMATIC PERI-, MYO-, AND ENDOCARDITIS*).
F. J. Poynton,

RHEUMATIC PERI-, MYO-, AND ENDOCARDITIS (ACUTE).—It is most essential that we should realize that these three lesions are not as a rule independent entities in rheumatism, but that the cardinal lesion of severe types is a carditis affecting to a greater or lesser extent all parts of the heart. Both in the child and adult these cardiac lesions are the ones that chiefly influence the prognosis of rheumatic fever, and because of their greater frequency in the child it is generally admitted that the prognosis is the more serious at this early age.

Another factor of importance is the character of the particular outbreak of rheumatism, which varies as do other infections. Thus in the severe outbreak of 1919–20, no fewer than 22 died of carditis, and 30 became complete invalids.

The outlook is very grave when severe carditis occurs in a child with a family history of rheumatism on both sides ; in the very young (five years and under) ; and in those who are surrounded by poverty and neglect.

The most virulent cases are liable to commence abruptly with somewhat unusual symptoms, such as vomiting and diarrhoea, severe shivering or sudden acute thoracic pains, and considerable fever. On the other hand, we must be prepared to find that a general carditis may gradually appear in some delicate children with remarkably few alarming signs, and though the course is more protracted than in the first group, the ultimate result may be most unfavourable.

1. Pericarditis.—This is the commonest cause of a fatal event in acute rheumatism. The cause of death is the general carditis, but the pericardial lesion is the most evident warning of this occurrence.

Some of the most dangerous cases show remarkably little fever, and the chart may even give a subnormal record. This is a point that should not be lost sight of by those who regard a fall of temperature at the time of the administration of salicylates as necessarily a good omen. Livid pallor, a rapid small pulse, great dilatation, and feeble cardiac sounds are signs of a deadly infection, whether nodules develop or not. Delirium is a bad sign, but it is not at all frequent in childhood ; great taciturnity is also serious. The fatal issue may be unexpectedly abrupt from syncope. Those who are acquainted with this virulent form of rheumatism will recognize at once from the general appearance and rapid development of the heart disease that the prognosis is very bad, for, should the patient rally for the time, the heart is usually irretrievably damaged, and the more speedy death is really the happier event. Fortunately, these cases are comparatively rare, and we know that pericarditis is more often an event in a recurrent attack of cardiac rheumatism. This fact is one of considerable interest, for it reminds us that with recurrent infection the resistance seems to lessen, a principle which may be also applied to the endocardial lesions.

The occurrence of nodules is much more frequent in the child than in the adult, and the lesion is one which leads us to consider with particular care the prognosis of the case. Dr. Cheadle made the general statement that these lesions were as a rule associated with

serious heart disease, and that the prognosis was accordingly grave. This general rule holds good. Thus, out of 39 of the writer's cases, that came to hospital showing nodules among other manifestations, 15 died. Still more recently, in a series of 33 cases, 12 died, and 15 became complete invalids.

Although, then, this lesion is a very important one in prognosis, we must not fall into the error of looking upon its occurrence as a sentence of death. The writer has seen rare cases in which the heart has been scarcely damaged, and in which excellent recovery has followed. There were two such examples in the above series of 33 cases. There are other cases in which the nodules disappear, and the heart, though damaged, makes a good recovery and becomes well compensated, and the child does not suffer from another attack of rheumatism while under observation. We must guard against the error of mechanical precision in judging these cases, and not permit ourselves, on detecting nodules, to state dogmatically that the condition is hopeless; on the contrary, though justified in fully admitting their prognostic importance, we must judge each case by the broad lines of clinical inquiry, and above all must estimate the degree of cardiac damage.

In adolescents the occurrence of nodules is also as a rule associated with grave, but by no means necessarily fatal, heart disease.

Among the less virulent cases, we can recognize a group in childhood in which there is obstinate and recurrent carditis, with a subacute and recurrent pericarditis. In these there are numerous manifestations, such as nodules and erythemata, endocarditis is invariable, and more than one valve may be attacked. The outlook is bad, for though these children may pass through one or more attacks, even in convalescence they never seem to be quite free from rheumatism, and the heart is irretrievably damaged. In London we see a number of these cases, of all degrees of severity, and they include some of our favourite and our most familiar hospital in-patients. There is a third group in which only a single acute attack of pericarditis may occur, and among them are seen examples of remarkable recovery, the heart apparently throwing off the infection with very little, if any, permanent injury. In a few of these the cardiac valves seem to escape entirely, although such an event always rouses the suspicion that the illness is not rheumatic. These are not difficult cases to recognize; the child is usually a strong one, the pericarditis is evanescent, the symptoms are mild, and the cardiac dilatation is fleeting. Unfortunately, in the hospital class we do not meet with many of them, but in the well-to-do they are more frequent.

In the adult, pericarditis is much less frequent, but when it occurs the prognosis must always be cautious, for here again it is an indication of a grave infection, and the damage to the myocardium is at this age a very serious event. Nevertheless, there are all grades of severity in the adult as in the child, and good recovery may occur even when the patient is over fifty years of age. The guiding principles lie in the estimation of the virulence of the attack and the degree of cardiac failure that results.

The prognosis of carditis and pericarditis must also be influenced by the degree of care in convalescence. At all ages this is of the greatest importance, and it is very advisable to picture the pathological changes that occur in this carditis, for thus alone can we realize the time that is needed for the inflammation to subside, the exudation to be absorbed or organized, and the heart to compensate for the necessary impairment of functions. Attention must be paid not only to the physical signs in the heart, but also to the general condition of the patient, for the heart may show good evidence of recovery, but the delicacy of the patient may warn us not to commence to apply the test of increasing calls upon its powers until this recovery has become assured for some while. We have to be reminding the parents continually that, for the child, the problem is not one of the immediate future but of his whole career.

It is useful in considering the prognosis of rheumatic pericarditis to recognize three main types:—

1. The acute and transient.
2. The subacute and relapsing.
3. The virulent form proving rapidly fatal, or, if less severe, leading irresistibly into the second variety.

The influence of adherent pericardium upon the prognosis takes us beyond the scope of acute rheumatism. (*See PERICARDITIS.*)

Pericarditis is always a long illness, although in the most favourable cases all activity of the lesion may be over in three weeks. The quieting down of active symptoms marks, however, only the commencement of that very gradual and cautious convalescence upon which the real progress so greatly depends. The guiding principle in this stage is not to take an abstract period of time, but to study the behaviour of the heart in each cautious forward step. Some patients get forward much faster than others, and these lose rather than gain by prolonged and complete rest. Others need more rest than would have been expected. In both instances, if progress is cautious, we can alter the details without doing any real harm, even if the advance has been a little too rapid. Taking 172 cases in children under twelve years, admitted for acute rheumatism of all degrees of severity, each one occupied a bed on the average for sixty days: some of them were many months in hospital, and left as invalids. It is the abrupt transition from invalidism to ordinary life that may alter the prognosis of this condition from good to bad. The temperature, the pulse-rate, the character and position of the cardiac impulse, and the nutrition of the patient are guiding points. Three weeks of normal temperature after a rheumatic pericarditis is, in general terms, a useful time to allow before attempting to make any forward step at all.

2. Acute Myocarditis.—The importance of this is well recognized, but the accurate estimation of its severity is not yet within our powers, and for this reason we must temper dogmatism with caution. The more modern methods of cardiac examination are helping us with the study of arrhythmias that may result from rheumatic myocarditis, but we must not take the occurrence of arrhythmia as necessarily an index of the power or weakness of the cardiac muscle, and we must remember also that the unit of arrhythmia—the extrasystole or premature contraction—is one which requires much more study before its true meaning is understood. Acute dilatation from myocardial poisoning may prove fatal even in childhood, but it is a very rare occurrence. When it occurs, there are such clear signs of cardiac failure and intense illness that the danger is apparent.

A much more frequent occurrence is cardiac dilatation, followed by the failure of the heart to compensate for a mitral lesion which clinically appears to be one of ordinary severity. These are the mitral cases that run such a disastrous course at all ages. The action of the heart remains feeble and rapid, and the dilatation only recovers in part. The child is short of breath, and cardiac tonics do not produce the effect that is wished. An adult, if forced by circumstances to return to work, soon breaks down, with evident signs of mitral insufficiency. In such cases, the factor of an adherent pericardium always comes in for consideration, but there is no doubt that in many of them no such complication has occurred. There can be little doubt that the most important element in the prognosis is the early recognition of this myocardial weakness, and a determined attempt to cope with it by prolonged rest and care at its first appearance. When once such a heart as this has been overstrained, the outlook is bad. It need hardly be added that, if this be true of mitral cases, it is even more so of aortic or combined mitral and aortic lesions.

There is a third group of cases in which the myocardium appears to suffer almost alone, and the valves to escape; these are not the virulent acute cases mentioned above, but those in which, after an attack of rheumatism, the heart remains dilated, the action rapid and often irregular; pallor, and symptoms of breathlessness, nervousness, and palpitation, with or without syncopal attacks, are prominent, and there is a real danger, owing to the absence of a definite valvular murmur, of considering the condition as neurasthenic. Such a condition is very obstinate, but in childhood good recovery may be made after many months. In adult life much will depend upon the occupation. The mildest examples of this condition are the transient dilatations which occur so frequently in first attacks of rheumatic heart disease, and from which recovery may be rapid and complete if their true meaning is appreciated.

It will be apparent that in dealing with the prognosis of myocarditis in rheumatism we are continually driven to realize its existence, not by a clinical sign, but by evidence that we have put too great a strain upon a heart which we believed was stronger than proved to be the case. This difficulty must always be remembered as one of the most important facts in the study of rheumatic heart disease.

Once more we may usefully recognize three classes:—

a. The acute simple dilatation which with care recovers completely.

b. The subacute obstinate cases that require much time and caution before a good result is obtained.

c. The virulent cases which may actually prove fatal, but more frequently much increase the danger of concomitant pericardial and endocardial lesions.

3. Acute Endocarditis.—Simple rheumatic endocarditis is never fatal, for the lesions are small, and would be negligible if it were not for the functions of the structure attacked ; but the bearing of these lesions upon the ultimate prognosis is of immense importance.

We can lay down some useful guiding lines upon this point from clinical experience. We recognize that the combined aortic and mitral lesion, particularly if the aortic is predominant, is a grave event. In childhood these cases, if severe, usually point to a great tendency to develop future attacks, and to a fatal termination before adult life is reached. The writer believes that if they survive to early adult life they are prone to develop malignant rheumatic endocarditis, and sometimes they develop frequent attacks of angina pectoris. The solitary aortic lesion is rare in childhood, but if severe the prognosis is bad.

Simple mitral endocarditis, if associated with grave myocardial weakness, runs a very disastrous course in the young ; but when, as is more usual, it is compensated, the outlook is good. If there is no further rheumatism, many of these cases recover in a way which can hardly be realized until they have been followed for some five or six years. The murmur, which was loud, and heard over a wide area, may disappear, or only be audible when the child is lying down, and even then perhaps only be recognized by the physician who has followed the case closely.

The writer believes that slight aortic lesions may also sometimes disappear.

Mitral stenosis does not, as a rule, give rise to symptoms in childhood, although its origin is frequent at this age, but if it does the outlook is bad. If, before puberty, recurrent bronchitis, embolism, or attacks of tachycardia, and cyanosis with dyspnoea, have occurred, or if there has been an attack of heart failure with dropsy as the result of this lesion, we must be prepared for invalidism and early death. On the other hand, slight mitral stenosis, though always more serious than slight regurgitation, may, after childhood, never make headway, and a useful life may follow. When, however, we take a broad survey of this lesion and couple with it the greater frequency of rheumatism in the poorer classes, we are forced to the conclusion that it represents a form of rheumatism which is most prone to dog the footsteps of its victim through life, and we find that death is very usual under forty-five years from chronic heart disease, or some accident associated with the lesion.

The following statistical points may be of service in helping the reader to focus some of the facts that bear upon the prognosis of rheumatic heart disease.

The mortality of rheumatic heart disease in children is proportionately greater in boys than girls, although, owing to the greater frequency of the disease in girls, the actual number of deaths may be greater. The most recent figures show this. Of 68 male children, 12 died—18 per cent. Of 104 females, 10 died—10 per cent. Further, out of 12 fatal first attacks, 10 were boys.

Allowing for the great difficulty there is in establishing without doubt that any particular attack is a first one, about 30 per cent of fatal cases occur in the first attack.

The age incidence of fatal cases rises to about the tenth year, thus :—

Up to 3½ years	-	-	-	-	0·6 per cent
3½ to 4½ "	-	-	-	-	3·9 "
4½ to 5½ "	-	-	-	-	7·4 "
5½ to 6½ "	-	-	-	-	9·4 "
6½ to 7½ "	-	-	-	-	12·7 "
7½ to 8½ "	-	-	-	-	12·7 "
8½ to 9½ "	-	-	-	-	15·3 "
9½ to 10½ "	-	-	-	-	20·0 "
10½ to 11½ "	-	-	-	-	12·0 "

At least 86 per cent of fatal cases of rheumatic heart disease show active rheumatism in the last illness, and death from chronic heart disease alone is very unusual. The cardiac lesions found after death are very definite and often very extensive.

In at least 90 per cent the pericardium is more or less damaged.

The mitral valve was damaged in 149 out of 150 cases, the aortic valve in 34 per cent, the tricuspid in 24 per cent, and the pulmonary in 3 per cent.

The multiple valvular lesions in the severe rheumatism of childhood are well exemplified by these numbers.

When confronted with a case of acute rheumatism in a child five years of age or under, the following figures will give an idea of the conditions that may be expected.

Eight out of 52 such cases proved fatal, that is, about 16 per cent.

Definite heart disease occurred in about -	85	per cent
Arthritis or arthritic pains - - - - -	70	”
Chorea - - - - -	35	”
Sore throat - - - - -	20	”
Nodules - - - - -	15	”

When we turn to adolescents and adults, and look into the after-histories of a considerable number, we come upon a very suggestive and interesting fact. Putting aside as beyond the scope of this article the numerous cases of death from chronic heart disease, we find the great danger is not carditis, but malignant endocarditis.

This point has such close bearing upon the prognosis in acute rheumatism, that the writer feels that he is not trespassing upon the ground of another contributor when he gives the examples shown in the table below.

Closely allied, and probably of the same nature, were 7 further cases in adults, the victims of repeated rheumatism in childhood, who showed many of the signs of malignant endocarditis, and eventually recovered for the time, after long and dangerous illnesses.

TABLE SHOWING THE SEQUENCE OF MALIGNANT ENDOCARDITIS UPON ATTACKS OF ACUTE RHEUMATISM.

Sex	Onset of Acute Rheumatism	Onset of Malignant Endocarditis
M	10 years - - - - -	13 years
M	6, 8, and 10 years - - -	16 ”
F	23 years - - - - -	37 ”
F	12 and 13 years - - -	14 ”
F	7 and 20 years - - -	21 ”
F	As a child - - - - -	37 ”
M	11, 14, 17, and 18 years -	19 ”
M	42 years - - - - -	50 ”
F	12 years - - - - -	16 ”
M	As a boy and at 16 years -	27 ”
F	12 years - - - - -	16 ”
M	7 years - - - - -	13 ”
F	12 years - - - - -	17 ”
F	8, 13, and 15 years - - -	24 ”
F	38 years - - - - -	48 ”
M	18 years - - - - -	28 ”
F	13 and 17 years - - -	27 ”
F	As a child - - - - -	32 ”

It is evident, then, that the physician who deals with acute rheumatism in the adolescent and adult must take into account the possibility of malignant endocarditis, and this particularly in the cases in which the aortic and mitral valves have both been damaged by previous rheumatism. Whatever interpretation he may choose to put upon the occurrence of these malignant lesions, the fact of their intimate, and in the writer's opinion, direct, association with the nature of the early illnesses cannot be put aside in the prognosis of acute rheumatism.

A study of 2000 post-mortem examinations upon adults brought home this fact to the writer, that more rheumatic patients die from malignant endocarditis than from an acute rheumatic carditis such as occurs in children, or indeed from any form of acute rheumatism that is generally recognized.

The influence of treatment by special drugs or by special methods upon the prognosis of rheumatic endocarditis is most difficult to estimate. The most important claim in recent years has been that the salicyl group, if used effectively, is a specific to the rheumatic process. The writer himself is not at all convinced upon this point, and would

express his own view by the statement that in a case of severe rheumatic carditis he would not feel confident that pushing these drugs would not do harm rather than good. He has seen this method of treatment used on many occasions, and yet at the time of writing has still this feeling of lack of conviction. Such a method as Dr. Caton's has much improved the prognosis of early endocarditis by demanding a complete rest for the patient, while a definite procedure, which in itself is devoid of any danger, is being carefully carried out by the physician. In the recent literature, the most decided claims have been made by Grenet, who treated rheumatic fever with intravenous injections of collo-biase of gold (*Medical Press and Circular*; 1916). His results showed: (1) An analgesic effect; (2) A fall of temperature; (3) Abbreviation of the attack; (4) *Suppression of the endocarditis*. Twenty minutes after the injection a severe reaction occurs, with fever, severe rigor, and sweating; this lasts about three hours. He states that of 76 cases, 1 died in the reaction, 1 from active heart disease, and the remainder showed no heart affection. The writer is not aware of further statistics with regard to this method of treatment.

F. J. Poynton.

RHEUMATOID ARTHRITIS.—(See ARTHRITIS DEFORMANS.)

RICKETS.—Rickets is a disease which invariably gets well when the patient passes from infancy to childhood, and although the older text-books describe a condition called 'late rickets', which is said to be a relapse, it is very doubtful if there is any real relation between them. It is customary, at the present time, to speak of the spinal curvatures, coxa vara, genu valgum, flat-foot, and similar deformities, as 'static', not rickety.

The prognosis as to the duration and severity of the rickety diathesis depends upon the treatment available. If animal fats can be obtained in sufficient quantity, it can soon be mastered. If not, the disease may persist in an active form till five or six years of age. Noel Paton and his fellow-workers in Glasgow have emphasized the importance of fresh air and exercise in preventing and curing the condition.

Whether the rickets is still active and likely to lead to further deformity, or whether it is obsolescent, may most conveniently be determined by the skiagram. If the epiphyseal cartilage is narrow and lies between parallel lines terminating the epiphysis and the diaphysis respectively, activity is at an end; if the epiphyseal cartilage is wide and merges irregularly into the ossified parts of the bone, the disease is still progressing.

Although the rickets passes away, the deformities of the bones, if of marked degree, will be permanent. Thus if, in a young child, the knees are two or more inches apart with the ankles touching, it is probable that the condition of bow-legs will persist throughout life, if not remedied by operation. There is, however, a not very uncommon form where a child is born with the legs slightly bent, and there is a decided separation at the knees throughout infancy, which only gets well when the art of walking has been thoroughly learned; it is important to distinguish this from genuine rickets, no other signs of which are present.

The most serious consequences of rickets are due to the coincident affection of the nervous system. Tetany (carpopedal spasm) usually indicates grave malnutrition. Convulsions in children are usually associated with rickets, and are occasionally fatal. Laryngismus stridulus, though alarming, very seldom threatens life unless there is an actual laryngitis present. Marked rickets makes the prognosis worse if the child should develop an acute infectious fever, such as whooping-cough or measles. *A. Rendle Short-*

RINGWORM.

Scalp.—The prognosis in ringworm of the scalp has been revolutionized by the introduction of the *x-ray* treatment. Under the old conditions—repeated shaving of the scalp and the application of ointments, lotions, etc.—it was common to meet with cases of two years' duration, even when every care was taken, and the ointments, etc., were applied by skilled persons. The writer has seen cases in which the endothrix fungus has been present for five years. The average duration of the residence of children in schools specially devoted to the treatment of ringworm, in Paris (Sabouraud) and in this country, was eighteen months. Under *x-ray* treatment, when complete epilation has been obtained, the scalp is usually free from infection in four or five weeks. Time has to be

allowed for the hair to grow, and the average period during which a child need be kept from school is about three months. Where a cap can be worn, the child may return to its usual surroundings immediately the infected hair has fallen, that is, in about five or six weeks.

Re-infection must be guarded against by the complete sterilization or destruction of all infected caps, hats, etc.

Favus of the scalp does not give quite such good results, because in severe cases the true skin is sometimes involved, and prolonged treatment after epilation may be required.

Glabrous Skin.—The prognosis is usually extremely good. With the removal of the infected epidermis by the use of iodine, or the application of ointments of chrysarobin, or of benzoic and salicylic acids in combination, as suggested by Whitfield, a cure can usually be effected in a couple of weeks. Care, of course, must be taken that there is no re-infection. The so-called *eczema marginatum* of the groin is a variety of ringworm, and this readily responds to treatment, especially to the benzoic and salicylic acid ointment. *Ringworm of the toes*, which often occurs in association with the *eczema marginatum* of the groin, is less easy to cure. The infection persists between the toes, and especially in the thickened epidermis on the plantar surface at the fourth interdigital space. Recurrences in this site are very common, and in some cases, where the nature of the condition has not been recognized, the trouble may continue for several years. The palms may be similarly affected, the eruption simulating pompholyx, and recurring every summer.

Nails.—Ringworm of the nails may persist for years. The fungus is commonly of the endothrix type, and cure is often very difficult. The fungus involves the ungual plate and the root of the nail, and forms thick masses of scale under its distal end. Many months' treatment by scraping, and the constant application of antiseptics such as iodine or mercurials, may effect a cure. Norman Walker has had better results by soaking the nail in Fehling's solution until it is softened, and then dressing the base with copper sulphate solution. Even complete avulsion of the infected nails and the application of strong antiseptics may be insufficient to bring about a cure; the writer has a case in which the infection has persisted for several years in spite of the fact that the nails have been removed on two occasions. Where the infection exists for a long time in the nails it is common to find the glabrous skin attacked from time to time, and this point should be borne in mind in cases of recurrent attacks of tinea of the smooth skin.

Beard.—If the affected parts are thoroughly freed from hair by the forceps, or still better by the x -rays, and then dressed with antiseptic ointments, the results are usually satisfactory. In the writer's experience, the more suppurative the ringworm of the beard, the speedier is the cure. It must be remembered that these cases closely simulate sycosis of coccogenic origin, which is notoriously difficult to cure.

J. H. Sequeira.

RODENT ULCER.—The prognosis in rodent ulcer depends upon early diagnosis. So long as the lesion is limited to the skin and subcutaneous tissue, there are several methods of treating it successfully. Radium therapy gives excellent results; I have cases of rodent ulcer treated by radium which have been free from recurrence for sixteen years. The proper application of the x rays, with or without preliminary curettage of the raised edge of the ulcer, gives similar results. Cases treated eighteen years ago are still free from recurrence.

Radium has occasionally proved successful when the x rays have failed to bring about a cure, and in the writer's opinion there are cases, especially where ulceration preponderates or there is deep infiltration, in which the converse holds true. In all cases treated by radium and by the x rays, the best results are obtained when the lesion reacts rapidly. If treatment has to be repeated again and again, the prognosis is not satisfactory.

Complete excision of a superficial rodent ulcer, with a good margin of healthy skin around and below the lesion, gives admirable results; but where the ulcer is near the orbit, and particularly at the inner canthus, the operator often errs by removing too little, and recurrences are inevitable.

At the International Surgical Congress in 1908, where the writer had the honour of presenting the *rapport* on radiotherapy, he recorded an average of 40 per cent of recurrences after treatment by the x rays. The statistics of operation were almost identical.

A larger experience has shown that with the proper selection of cases for radiotherapy, and improvements in technique, especially in the giving of massive doses through appropriate screens, these results have been materially improved.

Where a rodent ulcer has involved cartilage or bone, or where the orbital cavity has been invaded, the prospects of complete cure are more remote. Thorough and early clearing out of the orbit will often save the patient for some years. Removal of the maxilla, when the disease has involved that bone and the accessory sinuses, may be necessary. In some cases, a judicious combination of operation with radium and radiotherapy may effect a cure, but it is difficult to remove entirely the deeper foci of the disease without producing grave mutilation.

The prognosis as regards duration of life is not as serious as one would imagine, for patients often live for many years with a hideous cavity in the face. The writer has seen one such of forty years' duration. A fatal termination is brought about by septic infection of the sinuses of the skull, meningitis from extension to the cranial cavity, general sepsis, and exhaustion. Constant care in preventing septic infection, by the application of antiseptic dressings, irrigation, etc., alone can prevent these dangerous complications.

Mention should be made of the use of carbon-dioxide snow in the treatment of superficial rodent ulcer. Satisfactory results are often obtained, but relapses are more common than with radium or x rays. On several occasions the writer has had to apply radium after failure to cure a rodent ulcer with the solid carbon dioxide.

Gray recently showed a case of extensive disease in which an admirable result has been obtained by the revival of an old method of treatment, viz., the application of arsenical paste.

J. H. Sequeira.

RUBELLA (GERMAN MEASLES).—The prognosis in this disease is almost invariably excellent. I have met with but 1 death in between 400 and 500 cases. Corbin has reported that there was not a single death amongst 1523 consecutive cases admitted to the London Fever Hospital during the twenty-one years 1887 to 1907.

Complications are rare. I have twice observed *otitis media*. The fatal case referred to above occurred in a boy, age 3, who succumbed to *acute cardiac dilatation* following a slight attack of arthritis.

E. W. Goodall.

SALPINGITIS.—From the point of view of prognosis, a distinction is made between chronic non-suppurative inflammations of the tube and ovary, and the ordinary pyogenic suppurative conditions which are considered under the heading pyosalpinx.

Salpingo-oöphoritis.—There is probably no more difficult problem in gynæcology than in a given case of salpingitis to form an idea as to the end-results. In the majority almost all information is to be gained from the record of the subjective symptoms, and very little from physical signs, so that errors and uncertainties of diagnosis must be common. Although the symptoms and general reaction to an inflammation of the appendages may seem comparatively trivial, yet the far-reaching results of such a condition will make it necessary that a guarded prognosis be given, not so much concerning the immediate future as the end-results. In fact, the cases showing acute initial illness requiring active treatment, for that very reason often do better in the long run than the subacute forms.

The Infecting Organism.—Some difference in prognosis might be expected according to the infection. In some measure this is probably true; but the difficulty of diagnosing the nature of the infecting agent, in large part due to the similarity of symptoms irrespective of the causal agent, very frequently renders such information valueless. The tuberculous lesion is usually very chronic, commonly occurs in young unmarried or non-parous women, and is only temporarily relieved by prolonged palliative treatment. In gonococcal lesions, it is currently believed that with one tube infected the opposite tube is certain to become inflamed. Also, in acute gonorrhœal forms, one is rarely in fear that general peritonitis will supervene.

An inflammation following an abortion or occurring during the puerperium is usually of streptococcic nature, and produces a condition of pelvic peritonitis—a definite clinical condition known as *perimetritis*, ending in most cases in partial or complete recovery, or more rarely passing on to a pyosalpinx.

Effects of Salpingitis.—The effects, and more especially the remote effects, may be considered irrespective of the causal agent. In the first place, there is no doubt that pelvic adhesions in the majority of cases owe their origin to a previous salpingitis. These adhesions may be symptomless and only discovered during the course of other operative procedures; but generally they give rise to ill-defined symptoms of pain, varying greatly in intensity, and often causing considerable distress. The inability to recognize such adhesions on examination often leads to a diagnosis of neurosis, and to lack of success in treatment. Again, conditions frequently associated with salpingitis are the retro-displacements of the uterus, especially of the fixed variety. Or the development of a hydrosalpinx may give rise to pressure symptoms, or cause displacement of the uterus or rectum.

Sterility is a very common result of bilateral salpingitis, and tubal pregnancy is especially liable to occur in tubes kinked by adhesions.

The Results of Treatment.—

Expectant.—In the acute varieties of salpingitis the recognized form of treatment consists in absolute rest, douches, and saline purgation. Findley¹ quotes Fraub, of Amsterdam, as reporting cures in 70 per cent of cases as a result of this mode of treatment. The cures, however, were not absolute, as in a limited number there were relapses, but he maintains that at least 50 per cent of cases of salpingitis require no operative treatment. The average duration of treatment under this expectant method was six weeks; however, in some cases it was as short as three weeks, while in others it extended to as many months. Unfortunately, it is only the better classes who are able to submit to the longer periods of rest.

Finally, there is no doubt that there is a very good chance of recovery, if the treatment is persisted in. It has not infrequently happened that patients who have been recommended to submit to operation, and who have been pronounced to be very unlikely to conceive, have yet recovered and borne children.

Operative.—In the chronic forms of salpingitis, which do not react to medical means, and in which the symptoms indicate the necessity for further measures, the only alternative lies in surgical intervention. The immediate operative results are uniformly good, as is seen in the accompanying figures taken from the annual reports for the years 1912 and 1913 of the Chelsea Hospital for Women.² Number of cases operated on in 1912, 61—no deaths; in 1913, 55—no deaths; total of 116, with no deaths.

The operative risks are therefore not great; but it is necessary to consider how often this treatment leads to complete recovery. It is undoubtedly true that in a few instances relief does not follow operative measures; but this is often the result of omitting to remove the uterus as well as the tubes, or due to faults in technique, which in the near future may be much improved.

Pyosalpinx.—The operative treatment of pyosalpinx shows results very different from those in chronic salpingo-oöphoritis. It is in fact one of the most serious operations in gynæcology, the mortality being only exceeded by that of Wertheim's hysterectomy for carcinoma of the cervix. Thus, in the returns of the Chelsea Hospital for Women² for two years, operations for pyosalpinx were undertaken in 31 cases, with 5 deaths, a mortality of 16.1 per cent. Such a death-rate appears exceedingly high; but many of the cases were very seriously ill. Injury to the bowel during the course of operation accounted for a certain number of deaths.

In those cases recovering, there is a strong likelihood of adhesions forming between the peritoneally denuded surfaces of the pelvis and its viscera; also, when the uterus is preserved, unless the precaution of fixing it to the abdominal wall be taken, there is much likelihood of a fixed retroversion occurring during convalescence.

Tuberculous Salpingitis.—With regard to the operative treatment of this condition, the results seem to be uniformly good, provided the tuberculous material be all removed. No other measure can offer equally good results.

Patel and Ollivier³ give after-results of operation in 116 cases they followed up: 17 had died (9 as the immediate result of the operation and 8 within two years from tuberculous peritonitis); 19 were alive more than one year after the operation, but could not be seen; the remaining 80 were seen at a period which varied from a few months to several years after operation; of these 80, 8 had been treated by simple laparotomy, 17 by

removal of the tubes, and 55 by removal of the tubes and uterus. As the uterus is usually infected, the rule should be always to remove it together with the tubes. After operation, full general treatment (e.g. sanatorium) is necessary.

REFERENCES.—¹*Diseases of Women*, 1911, 467 ; ²*Chelsea Hospital for Women, Annual Reports*, 1912 and 1913 ; ³*Revue de Gyn.* 1912, ii, 147.

Bryden Glendining.
(Revised by Eardley Holland.)

SARCOMA OF BONE.—(See BONE TUMOURS.)

SARCOMA, MELANOTIC.—(See MELANOTIC SARCOMA.)

SCALDS.—(See BURNS AND SCALDS.)

SCARLET FEVER.—It will be convenient to consider the prognosis of this disease under the following heads: (1) *Age*; (2) *Sex*; (3) *Severity of attack*; (4) *Special symptoms*; (5) *Complications*.

1. **Age.**—During the years 1900 to 1909, 153,553 patients suffering from scarlet fever were admitted into the hospitals of the Metropolitan Asylums Board. The fatality at the different ages is shown in the following table:—

FATALITY ACCORDING TO AGE.

Age	Fatality per cent	Age	Fatality per cent	Age	Fatality per cent
0-1	14.7	0-5	6.3	25-30	1.6
1-2	11.1	5-10	1.7	30-35	1.5
2-3	8.0	10-15	0.9	35-40	2.8
3-4	5.5	15-20	1.1	40 and over	2.2
4-5	3.4	20-25	1.7	All ages	3.0

It will be seen that, under fifteen years of age, the younger the patient the greater is the chance of death. The first three years of life are the most dangerous.

2. **Sex.**—The fatality amongst males was slightly higher than amongst females: for all ages, it was 3.2 per cent for males and 2.8 for females; under five years of age, it was 6.7 for males and 5.9 for females.

3. **Severity of Attack.**—It is convenient, for the purpose of description, to divide cases of scarlet fever into three classes: the *malignant*, or toxic; the *anginous*, or septic; and the *benign*, or simple. The fatality of an epidemic or group of cases will depend, partly upon the proportion of each of these three groups, and partly upon the proportion of children of tender years. Malignant scarlet fever is extremely fatal; very occasionally an adult will recover; but I do not remember ever to have seen a case amongst children under ten years of age which was not fatal. In this form of the disease serious symptoms come on very rapidly, and, in children, death takes place within four days. A feature of malignant scarlet fever is the slightness of the faucial inflammation. But usually the temperature runs high, the rash is vivid, the pulse very frequent (150 per minute or more), the respiration sighing, and the skin and mucous membranes dusky. The patient is prostrate, delirious or comatose, and vomits frequently. Benign scarlet fever, on the other hand, is never fatal, unless through some complication (e.g., nephritis), and then but rarely.

Most of the deaths in scarlet fever are connected with the faucial lesions of the anginous variety, and these may assume various forms. Briefly, it may be stated that the more extensive the inflammation and the more extreme the swelling, the graver is the prognosis, because sloughing or ulceration, more or less widespread, is sure to result. conditions which are very favourable to the development of septicæmia or pyæmia. There is a variety of the disease, not often met with, which holds an intermediate place between the benign and the anginous forms in respect of the prognosis. I refer to what is known as the *typhoid form*. In this, the temperature remains raised for three or four weeks, and yet the faucial lesions are moderate in severity. If death takes place, it is nearly always due to some complication.

It is a prevalent idea that an attack of scarlet fever occurring in a pregnant or

recently delivered woman is more often than not of unusual severity. But my experience points in the opposite direction. During the twenty-one years 1892 to 1912, there were at the Eastern Hospital, Homerton, 40 cases of women who had been attacked by scarlet fever just before or just after delivery. In only 4 of the cases was the attack severe, and in only 1 could death be attributed to the scarlet fever. There were four other fatal cases amongst these women, but in all of these there was present, before the symptoms of scarlet fever set in, a septic condition due to retained placenta, laceration of the uterus, etc., which was quite sufficient to account for the fatal event.

4. Symptoms of Special Seriousness.—These are: repeated vomiting; continuous excessive frequency of the pulse (over 150, especially in adults); sighing respiration; coma; a prolonged high temperature; prolonged delirium and restlessness; a dusky or cyanotic appearance of the skin. These symptoms are most often met with in malignant scarlet fever, but they may be observed in some cases of the anginous form. To what has been stated above concerning the prognosis in the latter, it may be added that if, in spite of the return of the temperature to the normal and the improvement in the faucial lesion, the pulse-rate remains unduly frequent, the patient continues to waste, and there is looseness of the bowels and occasional vomiting, the prognosis is unfavourable.

5. Complications.—These are most frequently met with during or after an attack of anginous scarlet fever. Seldom is an attack of the malignant variety of sufficient duration to allow of their occurrence.

Cervical Cellulitis.—This is one of the most fatal complications; the more extensive it is, the more ominous it is. Those children seldom recover in whom the cellulitis involves the whole of the neck below the jaw, from one ear to the other.

Nephritis.—Marked albuminuria and diminution in the quantity of urine, occurring during the first week or two of an attack of scarlatina anginosa, are to be regarded with apprehension; for they are not infrequently the sole expression of a particularly severe form of nephritis. Should there also be coma or semi-coma, with muscular twitchings, the outlook is still more grave. A purpuric condition supervening at any stage of the disease is nearly always serious.

The common form of scarlatina nephritis, that which is a sequel rather than a complication of the disease, more often follows a severe than a mild attack. It may begin abruptly, with vomiting, pyrexia, hæmaturia, scantiness of urine, and occasionally a rigor. But it may also begin insidiously, with little else but albuminuria. On the whole, the more abrupt the onset, the less likely is the attack of nephritis to be prolonged; whereas the cases with an insidious beginning are usually tedious. The duration of an attack of nephritis varies from three to eight or ten weeks. The vast majority of the cases recover completely and do not become chronic.

It is not often that the renal lesion is the cause of death. When this event occurs, it is usually due to some such intercurrent affection as pneumonia or pericarditis; so that the occurrence of these complications is unfavourable. The fatality of nephritis is about 8 per cent, and is higher among children than adults. Of symptoms that are due to the nephritis itself, the most unfavourable are drowsiness, coma, a marked diminution in the amount of urine excreted, and extreme anasarca. The last symptom is seldom met with in cases that have been brought under treatment at an early stage. Convulsions, though serious, are by no means so grave as the symptoms just mentioned; they are prone to arise without the slightest warning, in cases which are not at all severe and are apparently progressing favourably.

The incidence of nephritis varies considerably. The average for the ten years 1900 to 1909 in the hospitals of the Metropolitan Asylums Board was 4.6 per cent in 153,607 cases of scarlet fever. It is highest in children, and especially in those between the ages of five and ten years, and of the male sex.

Rheumatism.—The prognosis of the articular rheumatism which not infrequently follows an attack of scarlet fever is usually favourable. It is not often that cardiac complications occur, at any rate in those cases in which arthritis is manifest. There are reasons, however, for thinking that endo- or pericarditis arises in the course of scarlet fever more often than is supposed; and that they either are overlooked, or do not give rise to symptoms, till long after the scarlatinal attack is past.

Pyæmia.—This is an extremely unfavourable complication of scarlet fever.

Laryngeal Affection.—Such an event is seldom met with except in the anginous form of the disease, and it makes the outlook grave. Even if the patient recovers, a more or less pronounced stenosis of the larynx remains.

Otitis Media.—The prognosis is usually favourable, provided that the appropriate treatment has been commenced early. But this complication is apt to resist treatment, which must, therefore, be carried out with unremitting care to prevent the occurrence of any serious impairment of hearing.

Tuberculosis.—An attack of scarlet fever will occasionally have a most prejudicial effect on patients who are the subject of tuberculous lesions. Not only is the part affected by tubercle likely to become worse, but nephritis is prone to occur and to be prolonged.

E. W. Goodall.

SCHISTOSOMIASIS.—This disease is caused by the *Schistosoma japonicum*, and is a chronic disease affecting chiefly abdominal organs, and producing cirrhosis of the liver and dysenteric symptoms. The prognosis is bad, about 10 per cent dying directly of the disease and a still larger proportion from secondary infections.

Leonard Rogers.

SCIATICA.—This term is applied to pain in the region of the sciatic nerve and its branches. Sciatica includes both *sciatic neuralgia* and *sciatic neuritis*, and in every individual case we have to decide which of these two is present.

Many cases of sciatic neuralgia occur independently of any affection of the nerve: e.g., in disease of the vertebræ (whether tuberculous or arthritic), in affections of the sacro-iliac joint or the hip-joint, in diseases of the femur (tumours, osteomyelitis, etc.), in intermittent arterial claudication, etc. In other cases, especially in gouty and rheumatic subjects, we have to do with a sciatic neuritis, in which the fibrous sheath of the nerve-trunk becomes thickened and inflamed.

Sciatic Neuralgia.—The prognosis of sciatic neuralgia, secondary to disease of other structures—vertebræ, pelvis, sacro-iliac joint or hip-joint, femur, etc.—depends upon the possibility of relieving the primary cause.

Sciatic Neuritis.—This is a somewhat obstinate malady; it may last for months or even years, varying in its intensity from time to time, and being specially liable to relapses. The presence of muscular atrophy, and the diminution or loss of the Achilles-jerk in the affected limb, indicate that definite degenerative changes have occurred in the nerve-fibres. Anæsthesia in the cutaneous distribution of the nerve is not common, and is indicative of a still more severe degree of degeneration. Nevertheless, the ultimate prognosis, even in long-standing cases, is usually favourable, except in senile and debilitated patients.

Bilateral sciatica is always a more serious affair. It may be due to diabetic neuritis, or it may be symptomatic of gross disease elsewhere, e.g., in the sacral region of the spinal cord or the cauda equina, or in the bones of the vertebræ or pelvis.

In every case of sciatic neuritis, rest and avoidance of violent movement are desirable. Recent cases often subside rapidly under hot local applications (e.g., hot poultices, radiant dry heat, hot mud-baths, electric-light baths, hot air, etc.), combined with anti-gouty or anti-rheumatic remedies, as the case may be. In other cases, excellent results are obtained by counter-irritation (e.g., by iodine, fly-blisters, or, better still, by a Paquelin cautery) applied to the tender points along the course of the nerve. Electrotherapeutic methods, in the hands of an expert, are often useful, especially the employment of a galvanic current, with or without ionization by various drugs; or, again, of the static wave current; or, in chronic cases, of static sparks along the course of the nerve-trunk. Sometimes obstinate cases of sciatic neuritis, which have resisted other means of treatment, are relieved by injecting directly into and around the nerve-sheath large quantities of saline solution (50 to 100 c.c.), to which may be added a small proportion of an analgesic drug (e.g., 1 per cent eucaïne); or the fluid may be injected, in smaller quantity, into the roots of origin within the sacral canal, by means of so-called epidural injection through the sacro-coccygeal fontanelle. Cutting down upon the sciatic trunk, dissecting it out, and forcibly stretching it, had a vogue some years ago, but is rarely prescribed nowadays; it appears to have no special advantages over saline injections.

J. Purves Stewart.

SCOLIOSIS.—The following factors govern the prognosis in scoliosis.

Apart from treatment, the deformity often gets worse in growing patients; but when growth ceases it is usually arrested. There is no tendency to natural cure. The patients are bad subjects for chest diseases later.

To find an answer to the question as to what benefit may be expected from treatment by exercises, massage, etc., the patient's spine must first be put into the best possible position by the surgeon's hands. It will be possible to make that position habitual by treatment; but if the hands do not overcome bony deformity, the exercises will not do so. It is usually safe to promise relief of pain and prevention of further progress of the scoliosis.

Certain other factors influence the outlook.

1. **The Cause.**—If there is a contracted chest, unequal length of the legs, or severe muscular paralysis, not much can be done to straighten the spine.

2. **The Age and Duration.**—Recent cases are better than old-standing. The younger the patient the worse the prognosis. Children under six or seven do badly.

3. **The Type of Patient.**—Shy, shrinking girls, who will not try to 'stand up like a soldier', and are careless of their personal appearance, are unfavourable subjects.

4. **The Degree of Deformity.**—The deviation of the vertebræ matters more than that of the spinous processes. Fixed bony deformity cannot be cured; but with the same initial degree of deformity there is much variation in the results of treatment. High or low curves in the spine are unfavourable.

5. **The Nature of the Treatment.**—In early cases, without bony fixation in a bad position, exercises, posture, and massage give the best results. In old, fixed cases it will be necessary to supplement this by a supporting jacket to relieve aching pain. By cutting a window over the concavity of the scoliosis, and introducing an inflatable rubber air-pad over the convexity beneath the plaster, the deformity can be remedied to some extent. In certain cases, six months on a Whitman frame with three bands round the chest and abdomen, pulling so as to straighten out the curves, may effect improvement (Albee).

REFERENCES.—Tubby, *Deformities, including Diseases of Bones and Joints*, 1912; Noble Smith, *Curvature of the Spine*, 1896; Roth, *Clin. Jour.* 1914, 144.

A. Rendle Short.

SCROTUM, CARCINOMA OF.—This disease is uncommon, except in sweeps and tar-workers. It is one of the least malignant of all forms of carcinoma, but we have very little in the way of exact statistical evidence bearing on the point. Patients sometimes present themselves who have already had the growth for years. No doubt, apart from treatment, it would always be fatal at the last.

The Operation Mortality is small. Of 58 cases at St. Bartholomew's Hospital, 2 died, both being very bad subjects. Probably clearance of the groin glands would slightly increase the mortality.

The End-results have been studied by Butlin.¹ Excluding 2 cases which died from the operation, and 2 more in which the glands were involved but not removed, we have the following: 7 cases recurred; 5 cases, followed one to three years, are well; 8 cases, followed over three years, are well.

Even amongst the recurrences, a second operation was several times successful. It is true that recurrence is occasionally very late; probably, in some instances, it is really a new cancer.

We have no figures to show whether it is wise to remove the groin glands. This was done in some of Butlin's cases, but not in all.

REFERENCE.—¹Butlin, *Operative Surgery of Malignant Disease*, 2nd ed.

A. Rendle Short.

SCURVY.—Scurvy is not nearly so common as formerly, and its more severe aspects are now practically never seen in this country. In the eighteenth century the mortality from scurvy was appalling; in Lord Anson's voyage round the world in 1740–44, 380 out of 510 seamen died of the disease. Present-day mortality in this country is well under 1 per cent. Since the disease is now known to be due to the lack of the antiscorbutic vitamin, prognosis mainly depends on the availability of means of suitable treatment. The use of germinated peas, as suggested by Miss Chick and Miss Hume, was of great service in the Archangel campaign (1919), when conditions made the supply of fresh meat

and vegetables impossible and the ration lime-juice was found to be of little effect. Unless the patient when first seen is dangerously ill, recovery may almost certainly be predicted. The most important danger is sudden syncope. This must be met by keeping the patient absolutely quiet in bed for a week. After that period the danger has passed, and restoration to health may be looked for at the end of a fortnight. As the patient improves, a striking change in his aspect will be noticed. The subcutaneous and intramuscular indurations clear away; this is followed by a return to normal of the gums, and lastly by a disappearance of the petechiæ. The tendency for wounds to break down and ulcers to form ceases when treatment begins, and healing is rapid.

When scurvy has come under treatment, the only danger to life, apart from the possibility of syncope, arises from the existence or onset of a complication. Pneumonia is thus a source of danger. Pleurisy and pericarditis, even when the effused fluid is sanguineous, usually clear up. A complication such as dysentery may cause symptoms to persist. Hæmorrhage is not usually of serious import, and, apart from epistaxis, is uncommon.

G. L. Gulland.
A. Goodall.

SEPTICÆMIA.—With the rarest possible exceptions, true septicæmia—septicæmia, that is, confirmed by finding bacteria of suppuration in the blood—is inevitably fatal within a few days, and the prognosis is really the diagnosis. Here belong those cases in which a patient, sometimes a nurse or doctor, is taken acutely ill with what appears to be a severe type of influenza: where there is little or no sign of inflammation at the site of entry, and where the utter prostration, high fever, septic rashes, diarrhœa, or onset of peritonitis or abscesses, leads to an examination of the blood. It is always a very grave sign when effectual treatment of the primary focus of a suppuration does not produce marked improvement within two days. Occasionally one sees cases of probable septicæmia in which antistreptococcus serum seems to work like a charm. Intravenous eusol seems to save a few.

Whilst the above remains true for the cocci of suppuration, recent research shows that other organisms can be found free in the blood, without any immediate danger to the patient's life. It is common to find the Eberth bacillus in the blood of an early case of typhoid fever. According to Calmette, a tuberculous bacteriæmia is not very rare in children, giving rise to symptoms like typhoid fever, but recoverable.

A. Rendle Short.

SINUS IRREGULARITY.—(See PULSE, IRREGULARITIES OF.)

SINUS THROMBOSIS.—(See INTRACRANIAL COMPLICATIONS OF EAR DISEASE.)

SINUSITIS.—(See NASAL ACCESSORY SINUSITIS.)

SKULL, INJURIES OF.—(See GUNSHOT WOUNDS; HEAD INJURIES.)

SLEEPING SICKNESS.—(See TRYPANOSOMIASIS.)

SMALL-POX.—The prognosis of this disease must be considered in so far as it is influenced by the following factors: (1) *The Age*, (2) *Sex*, and (3) *Race of the patient*; (4) *Nature of the attack*; (5) *Presence of special symptoms*; (6) *Occurrence of complications*; (7) *Character of the epidemic*; and, further, by the very important factor, (8) *The condition of the patient in respect of vaccination*.

1. **Age.**—Amongst the *unvaccinated*, all the evidence goes to show that small-pox is very fatal to the young. If we refer to times in which the disease was not controlled by vaccination, we find that amongst the total number of deaths from small-pox at all ages, the proportion amongst children under five was very high. Thus, at Geneva, during the years 1580 to 1760, there were 25,349 deaths from small-pox; 83 per cent of these were children under five years of age, and 48 per cent were under two. At the Hague, for fifteen years, the proportion of deaths under five was 73·4 per cent; in Sweden, during the years 1770 to 1798, 78·4 per cent; in Kilmarnock, during 1728 to 1764, 90·5 per cent; in Chester, in 1774, 89 per cent; in Manchester, during 1768 to 1774, 95 per cent; in Warrington, in 1773, 94 per cent; and in Edinburgh, during 1764 to 1783, 94 per cent. (See Dr. J. C. McVail's evidence before the Royal Commission on Vaccination.) There are no records which are extensive or accurate enough to furnish a

definite statement as to the fatality at the different ages in those times ; but if we argue from what has taken place amongst the unvaccinated during recent years, we may safely assert that then, as more recently, the fatality amongst young children was high. The following table has been compiled from the annual reports of the Metropolitan Asylums Board (London), for the years 1892 to 1895 and 1901 to 1903, and from the reports of small-pox epidemics in several large towns in England (Leicester, Gloucester, Manchester, Oldham, Chadderton, and Bradford) during the period from 1892 to 1896, made to the Royal Commission on Vaccination. All cases doubtful as regards vaccination are excluded from these figures.

FATALITY OF SMALL-POX AMONGST THE UNVACCINATED,
ACCORDING TO AGE.

Age	Cases	Deaths	Fatality
			per cent
Under 5	1510	645	42·7
5 to 9	1253	246	19·6
10 to 14	663	115	17·3
15 to 19	393	77	19·5
20 to 29	447	131	29·2
30 to 39	152	62	40·7
40 to 49	73	43	58·9
50 to 59	26	12	46·2
60 to 69	15	7	46·6
70 and over	6	2	33·3
Total cases	4538	1340	29·5

From this table it appears that, during the epidemics from which the figures are derived, the fatality was very high amongst children under five, that it fell considerably during the next two quinquennial periods, and then quickly rose again. But even the lowest fatality, 17·3 per cent for children between the ages of ten and fifteen years, is high ; and the fatality for all ages, 29·5 per cent, is very high compared with that which is found in such diseases as typhoid fever and scarlet fever.

Amongst the *vaccinated*, however, i.e., those vaccinated in infancy, the prognosis is very different. The following table has been drawn up from the same reports of the Metropolitan Asylums Board and the Royal Commission as were employed for the preparation of the table given above relating to the unvaccinated, so that the two tables are very rightly comparable.

FATALITY OF SMALL-POX AMONGST THE VACCINATED,
ACCORDING TO AGE.

Age	Cases	Deaths	Fatality
			per cent
Under 5	39	1	2·5
5 to 9	285	2	0·7
10 to 14	870	7	0·8
15 to 19	1752	30	1·7
20 to 29	4648	219	4·7
30 to 39	3097	335	10·8
40 to 49	1571	239	15·2
50 to 59	552	89	16·1
60 to 69	221	47	21·2
70 and over	66	13	19·5
Total cases	13101	982	7·4

From this table we find that, amongst the vaccinated, the fatality rate is under 5 per cent for persons under thirty. It is especially low between the ages of five and fifteen, being less than 1 per cent. After thirty, the fatality rises, and it is about

20 per cent amongst those over sixty. But even the highest fatality rates amongst the vaccinated are only a trifle higher than the lowest amongst the unvaccinated. And it may be concluded, from a comparison of the two tables, that while infant vaccination affects most favourably the prognosis at all ages, the most beneficial effects are to be noticed in those under thirty years of age, and especially in children between the ages of five and fifteen.

Unmodified confluent small-pox is extremely fatal in children under two years of age, and very fatal in those between two and five.

2. Sex.—Most authorities state that sex has very little influence on the prognosis. There are, however, few statistics, bearing on the point, in which the vaccinated are distinguished from the unvaccinated cases. During the years 1892 to 1895, 534 unvaccinated males and 537 unvaccinated females were treated in the Small-pox Hospital of the Metropolitan Asylums Board; 90 males and 112 females died, so that the fatality amongst the former was 16·8 per cent, and amongst the latter 20·8 per cent. But these figures are too small to warrant a general conclusion. During the same years, and at the same hospital, 1883 vaccinated males and 1365 vaccinated females were treated: of the former, 58, or 3 per cent, died; of the latter, 40, or 2·9 per cent; so that in these cases the fatality was the same in each sex. Welch and Schamberg state that in certain epidemics in Philadelphia the fatality amongst 4593 males was 27·4 per cent, and amongst 2606 females 25·7 per cent; and McCombie puts the male fatality at 1 per cent higher than the female. These writers are referring to vaccinated and unvaccinated cases taken together.

3. Race.—It has been stated by more than one author that small-pox is much more fatal amongst the dark races of mankind than amongst the white. There is historic evidence to show that when the disease has been introduced into certain countries for the first time (as into Mexico when it was conquered by the Spaniards), the mortality, and apparently also the fatality, has been very high. The statement made above concerning race may have been true to a certain extent so far as the more remote past is concerned; but it is doubtful whether it is true at the present day. The following figures, given by Welch and Schamberg, refer to unvaccinated patients treated in the Philadelphia Municipal Hospital: Amongst 2036 whites there were 910 deaths, a fatality of 44·7 per cent; while amongst 637 negroes there were 315 deaths, a fatality of 49·4 per cent. The figures are scanty, and the difference in the fatality rates not very great. But the character of the epidemic is of great importance. Thus, the writers just quoted state that during the years 1898, 1899, and 1900, small-pox of an extremely mild type prevailed in certain parts of the United States, and that they treated in hospital 162 patients (of whom 138 were unvaccinated) without a single death; 150 of the patients were negroes. A very mild form of small-pox (known as Amaas) has also been prevalent during recent years amongst the Kaffirs in South Africa. This evidence, therefore, goes to show that race has very little influence on the mortality.

4. The Nature of the Attack is of great importance. I have added together the figures presented to the Royal Commission on Vaccination, which were obtained from various authorities, from Marson (1836 to 1851, at the Highgate Hospital) to Coupland (1896, in the Gloucester epidemic).

Amongst the *unvaccinated*, I find that of 478 malignant or hæmorrhagic cases, 451 died, a fatality of 94·3 per cent; of 5258 confluent cases, 2393 died, or 45·8 per cent; and of 1068 discrete (including those classed by Coupland as coherent) cases, 57 died, or 5·3 per cent. It will thus be seen that nearly all the hæmorrhagic cases are fatal. In respect of the confluent and discrete cases, the age of the patient must be taken in conjunction with the character of the attack (see table given above); most of the deaths in discrete small-pox occur amongst children under three years of age.

Amongst the *vaccinated*, I find, from the figures given by the observers just quoted, that of 529 malignant cases, 425 were fatal, or 80·3 per cent; of 5394 confluent cases, 963 died, or 17·8 per cent; while of 9603 discrete cases, 42 died, or 0·4 per cent. It will be observed that in both the vaccinated and the unvaccinated the prognosis in the case of malignant small-pox is very grave. In confluent small-pox the prognosis is grave in the unvaccinated, much less so in the vaccinated. In all forms the prognosis is much more favourable in the vaccinated than the unvaccinated.

Generally, it may be stated that the more profuse the eruption of pocks, the graver is the prognosis.

5. Special Symptoms.—If the symptoms of the prodromal or initial period be mild, then the attack (eruptive stage) will be mild. But if the initial symptoms be severe, the eruptive stage will not necessarily be severe. Often it will be ; often, also, it will not. Even an attack which proves to be very much modified is occasionally ushered in by severe initial symptoms.

Rashes.—Of the initial rashes, the scarlatiniform and morbilliform erythemas, whether generalized or local, are usually favourable, especially when the patient is vaccinated. The same remark is true of the pale sepia erythema described by Thomson and Brownlee under the designation 'capnitoid'. The generalized livid (dark plum-coloured) erythema is of very bad omen ; so also are the erysipelatoid (astacoid) erythemas, local or generalized.

The hæmorrhagic initial or prodromal rashes are, on the whole, very unfavourable. When the hæmorrhages are small (petechial), not very numerous, and of a bright-red colour, the prognosis is not so grave as when they are small, very numerous, and of a purple hue. The vaccinated person has the better chance.

The occurrence of scattered, purple, blue-black, or inky cutaneous and subcutaneous hæmorrhages is very ominous. In the very worst cases there is also an erysipelatoid erythema. The presence of hæmaturia, metrorrhagia, or bleeding from other mucous surfaces aggravates the prognosis.

The symptoms last mentioned are amongst those which are to be observed in malignant or hæmorrhagic small-pox, which, as we have seen, is an extremely fatal form of the disease. Death may take place on the third to sixth day, before the eruption of pocks has made its appearance. Not only the hæmorrhagic but the erysipelatoid initial rashes are prone to occur in malignant small-pox. The lumbar pain is often unusually severe. There is some hope of recovery in that form of hæmorrhagic small-pox in which the hæmorrhages are limited to the skin immediately beneath and around the pocks.

Pocks.—It has already been stated, in regard to the eruption of pocks, that the more profuse it is, the graver is the prognosis. The outlook is especially bad when the eruption is already confluent in the papular stage ; then the papules are often softer and less prominent than usual. In the vesicular and pustular stages, it is an unfavourable sign if the pocks are whitish, flat, and collapsed, and if there is little or no swelling of the skin. It is, on the other hand, a favourable sign if the pocks, even though very numerous, run through the stages of vesiculation and pustulation to incrustation more quickly than usual ; if the pocks are superficial ; if they are small or of variable size ; and lastly, if, whether in the vesicular or pustular stage, they are ill-developed. These modifications of the cutaneous lesions are, at the present time, most often due to previous vaccination.

If there are many pocks on the mucous membranes of the mouth, palate, pharynx, and especially larynx (as shown by signs of laryngeal obstruction), the gravity of the prognosis is much augmented.

In hæmorrhagic small-pox, the fatal event often takes place on the third to sixth day ; in confluent and severe discrete cases, the dangerous period is that of the supuration of the pocks, that is, from the sixth to twelfth day of the eruption (eighth to fourteenth of the illness). Complications are very likely to set in during this stage.

Other Symptoms.—Marked restlessness, insomnia and delirium, convulsions, coma, prostration, profuse diarrhœa, and, in children, grinding of the teeth, are all unfavourable symptoms.

6. Complications.—These are especially to be expected in the most severe cases, either during, or soon after, the period of suppuration of the pocks. Those which are both frequent and serious are œdema of the lungs, acute bronchitis, lobular pneumonia, acute dermatitis and cellulitis with suppuration, erysipelas, septicæmia, and pyæmia. More serious, but infrequent, are lobar pneumonia, empyema, gangrene of the skin (especially of the scrotum), arthritis, and acute myelitis. Ocular complications are common, especially after confluent and severe discrete attacks. Extreme inflammation and swelling of the lids is serious and leads to conjunctivitis, corneitis, corneal ulcer, and panophthalmitis, so that if the patient survives the attack of small-pox, his sight may be lost or impaired ;

but conjunctivitis and corneitis may occur independently of œdema of the eyelids. Otitis media is met with chiefly in children.

Influence of Pregnancy.—In Welch and Schamberg's book on *Acute Contagious Diseases*, a table is given in which are shown details of 113 cases of small-pox in pregnant women. From this table it appears that in 67 of the 113 cases, or 59 per cent, abortion or premature delivery took place; 7 of the patients, or 6 per cent, died undelivered; 20, or 18 per cent, recovered and went to delivery at full term; and 19, or 17 per cent, left the hospital still carrying the fœtus, and no further information was to be obtained concerning them.

In 73 cases in which the woman was attacked by small-pox before the completion of the seventh month of pregnancy, 41 aborted, or 56 per cent; while of 39 attacked after the seventh month, 25 were delivered prematurely, or 64 per cent.

The fatality was much higher in those who were prematurely delivered than in those who were not; of the 67 in the former class, 28 died, or 41·7 per cent; while of the 46 in the latter, 7 died, or 15·2 per cent.

Miscarriage takes place most frequently during the eruptive stage; but the earlier in the attack it occurs, the more likely is the event to prove fatal. The more severe the attack, the greater the risk of premature delivery and death. Vaccination has a great influence in prognosis. Of the cases quoted, 27 had not been vaccinated and 20 of them died, a fatality of 74 per cent; of 85 cases in which vaccination had been performed "at some previous remote period", 14 died, a fatality of 16 per cent.

The writers point out that the death-rate of small-pox in pregnant women varied in different epidemics; in their series, in three different epidemics, it varied from 13 to 51 per cent. The miscarriage rate varied less widely, from 55 to 61 per cent. In the very mild epidemic which prevailed in Trinidad during 1902 to 1904, Scheult found that 27 out of 89 women miscarried, or 30 per cent; none died.

On the whole it may be concluded that an attack of small-pox is a most serious event for a pregnant woman; and that the vaccinal condition of the patient and the nature of the attack are of prime importance in determining the issue.

In respect of the child, the earlier in gestation the mother is attacked by small-pox, the more likely is the child to perish. In the later months, the child may be born with the eruption of small-pox out upon it, or, if it live, it may develop the rash later. A living child born of a variolous mother may not have small-pox at once, and yet is rarely immune to vaccination.

7. Character of the Epidemic.—Allusion has already been made to this factor when the question of the influence of race was under consideration. One epidemic will differ very widely from another in respect of its case mortality, that is to say, of the virulence of the immediate cause of the disease, whatever it may be. The fatality of the London epidemic of 1902 was 16·8 per cent, and of that of 1903 3·4 per cent. The epidemic in Sydney in 1913 was characterized by extraordinary mildness. Up to the end of that year there were 1070 cases, with but 1 death. Even young children had the disease in a mitigated form. Of the persons attacked, 93 per cent had never been vaccinated. This outbreak was also characterized by its low power of infectivity.

8. Vaccination.—One or two more points require to be dealt with under this heading which have not been touched upon in the previous paragraphs. It will be seen from the table, given above, of the fatality of small-pox in the unvaccinated, that on the whole it increases with age, that is, with the lengthening of the interval between vaccination in infancy and the attack of small-pox. We must now consider the question of the expectation of an attack of small-pox in those who have been vaccinated in infancy, when they are exposed to the infection of the disease. Very careful investigation into this point was made in the epidemics at Sheffield, Warrington, Dewsbury, Leicester, and Gloucester, and the results were reported to the Royal Commission on Vaccination. The inhabitants of houses invaded by small-pox in those epidemics were divided into two classes, the unvaccinated and the vaccinated. The number of persons in each class was enumerated, and also the number in each who were attacked by small-pox. A further separation was made of these persons into two groups, those under ten years of age, and those of ten years and over. Adding the totals from the five towns together we get the following figures:—

PROPORTION OF UNVACCINATED AND VACCINATED PERSONS EXPOSED
TO ATTACK WHO WERE ATTACKED.

Condition	Under ten			Over ten		
	Number of Persons	Number attacked	Percentage	Number of Persons	Number attacked	Percentage
Unvaccinated	2317	1133	48.8	1195	631	52.8
Vaccinated	5810	449	7.7	20822	5997	29.0

It will be noticed that the attack rate in the unvaccinated is not very different in those under or over ten. In the vaccinated, however, the attack rate is four times higher in those over than in those under ten. These figures deal almost entirely with persons vaccinated in infancy. The protective power of vaccination wanes as the length of time from the vaccination increases. But even after its power of preventing an attack of small-pox has gone, its influence in modifying the attack remains for a considerable time. It may also be stated that the incidence of the severe forms of small-pox is much less amongst the vaccinated than the unvaccinated.

The prognosis is also affected by the *efficiency of the vaccination*, as measured by the number and character of the vaccination scars. The larger the total area of the vaccination marks, the better the prognosis.

Re-vaccination will restore to the already vaccinated individual any loss of the immunity conferred by the primary vaccination. It is rare to meet with attacks of small-pox, and still more rare to meet with fatal cases, in persons who have been successfully re-vaccinated.

E. W. Goodall.

SPINA BIFIDA.—We shall have to consider: (1) *The prospects of survival apart from treatment*; (2) *The results of injection methods*; and (3) *The prognosis after operation*.

1. Survival apart from Treatment.—It is quite certain that the patient may, in rare cases, survive and grow up. The report of the Clinical Society,¹ many years ago, was able to present about a dozen such cases, several of whom were over twenty, and two over forty, years of age; one or two had obtained a spontaneous cure by shrinkage. Nevertheless, this happy event must be regarded as very exceptional. In 1882, of 649 cases of spina bifida dying in England, 612 were in their first year, and a great number of these died within the earlier months. Morton estimated that only 1 per cent grow up without treatment; this is probably too low a figure. Of 90 cases not operated on, 20 lived to the age of five.

The causes of death are rupture, leading to fatal drainage of fluid; meningitis; and hydrocephalus. The children who survive frequently suffer from cystitis, and may be paralyzed in their legs.

The only cases in which there is a reasonable prospect of survival are those of meningocele with a thick skin covering.

2. Results of Injection of Morton's Fluid.—On paper, this is by far the best method of treatment. According to the report of the Clinical Society, of 71 cases, 35 were cured, 27 died, 5 were improved, and 5 not improved. Morton² himself had 29 patients, of whom only 6 died. But a closer examination presents the picture in a very different aspect. The operative procedure is, of course, by no means so dangerous as an excision, and therefore those dying within a month are fewer; but the great majority of the 71 cases given in Morton's book have only been followed for a very short time; and when the book appeared, 24 of those whose history had been followed up were known to be dead. The cure was often partial; manyappings and injections were necessary in several instances, and occasionally there was no improvement even after this. It is therefore quite impossible, from such evidence, to obtain figures sufficiently reliable to compare with those obtained by operation. One can only say, in general terms, that the procedure itself is not very dangerous, even in young infants; that, if repeated, it usually causes some shrinkage of the sac; but that a great number eventually succumb

to intercurrent ailments. At the Children's Hospital, Manchester, of 12 cases, 3 were cured, 8 died, and 1 was not improved.

Probably modern surgery has gone too far in abandoning the injection of Morton's fluid so completely as it has done.

3. Prognosis after Operation.—It is extremely difficult to obtain figures which are really comparable, because of the variations in the age at which the operation is performed. If the surgeon waits until an age when the weakly children will have died off, good figures can be obtained; if he operates in early infancy, in hopes of saving a few who would otherwise die, there will be a heavy mortality. A number of the children succumb in the next few months, even after operation.

Nicoll,³ of Glasgow, reports the results of excision in 32 cases, mostly young infants, treated by himself; but unfortunately they were not usually followed up more than a month or two; of these, 7, or 21·8 per cent, died within a month.

Sachtleben,⁴ in 1903, recorded 18 operations in Mikulicz's clinic. Of these, 6 died soon after operation; of 12 recoveries, 6 died within a year. Only 6, therefore, were alive a year after; 5 of these were completely cured, all being, in the first place, meningoceles.

Moore,⁵ in 1905, made a study of all the cases treated by operation mentioned in the Surgeon-General's Index Catalogue for nearly a century. He estimates that the mortality at the present time, amongst children with spina bifida operated on in infancy, is about 35 per cent, and that not more than half the total number are alive at the end of a year. If operation is postponed until they are five years old or over, the mortality is only 4·7 per cent. Even after operation, infants may develop hydrocephalus, paraplegia, or incontinence; and if these conditions were already present, it is very unlikely that they will be improved.

Boettcher reports a series of 39 cases operated on by himself; 13 died, and of the 26 survivors 12 died within a few months, and 14 (that is, 36 per cent of the whole) were cured. These were all cases of meningocele.

At the Manchester Children's Hospital,⁶ out of 8 cases treated by operation, 5 recovered and 3 died. The age is not stated.

At two Bristol hospitals, 10 infants have been operated on: 6 died, five of the deaths occurring within a few days; 1 has been lost sight of; 3 are alive, respectively three, five, and eight years after the operation. Of these three, one is quite well, another has incontinence, and the third has paralysis of the legs dating from the operation. Of 7 children not operated on, 6 died within a few months, and 1, age three years, is still alive, paralyzed, idiotic, hydrocephalic, herniated, and always ailing.

Summary.—We may conclude, therefore, on the rather unsatisfactory evidence at present available:—

1. That survival is quite exceptional, apart from treatment; and a surviving child will often be paralyzed and suffer from incontinence of urine or hydrocephalus.

2. That injection of Morton's fluid is comparatively safe at the time; but probably half the cases die within a few months, and in about one in seven the spina bifida is not cured.

3. That operation in early infancy has an immediate mortality of 35 per cent, and less than half the cases grow up; it cures the spina bifida, but will not improve any paralysis, incontinence, or hydrocephalus. In older children, over five, the mortality is low (about 5 per cent) and the prospect of cure excellent.

Cases of meningocele with a thick covering are favourable; syringomyelocoele and meningocele, especially with a thin covering, usually threaten early death, which is scarcely a calamity in view of the probability of helplessness and feeble intelligence in the child if it survive.

REFERENCES.—¹*Trans. Clin. Soc. Lond.* xviii, 339; ²Morton, *Spina Bifida*, 1887; ³Nicoll, *Brit. Med. Jour.* 1898, ii, 1142; ⁴Sachtleben, *Centr. f. Chir.* 1904, 341; ⁵Moore, *Trans. Amer. Surg. Assoc.* 1905; ⁶Thorburn, "Spina Bifida", *Burghard's System of Operative Surgery*.

A. Rendle Short.

SPINAL CARIES.—The following points demand attention in attempting to forecast the prognosis for patients with tuberculous disease of the spine: (1) *The prognosis as to life*; (2) *The prospects of cure in ordinary cases, and length of time likely to be necessary*; (3) *The prognosis when paraplegia is present, and the value of laminectomy*;

(4) *The prognosis when the disease is complicated by abscess formation, and notably by psoas abscess.* This is dealt with elsewhere (see PSOAS ABSCESS); (5) *Prognosis after operations to fix the spine.*

1. Prognosis as to Life.—Undoubtedly patients with spinal caries run some risk of early death. According to some old authorities quoted by Tubby, about a third of the cases die within a few years of the onset. Nowadays it is quite certain that with anything like favourable circumstances and proper treatment the danger to life is much less than this. In 1903 Goldthwait published a study of the end-results of 62 cases treated in a Boston hospital and followed up till eight years afterwards, and including 20 with abscesses and 11 with paraplegia, only 11 dying (including 8 abscess cases and 2 paraplegics). Of 517 cases in children, followed on an average for seven years, treated at the New York Orthopedic Hospital, 21 per cent died. The report was published in 1917. Tubby followed 99 cases for two and a half years; of these, 12 died. Patients seen in private practice, or able to be treated at an open-air hospital, do better still, and the true mortality is well under 10 per cent. Of 920 cases at Alton, the mortality was only 3·4 per cent. It must be admitted, however, that the patients are usually delicate all their days, and not likely to reach a great age.

Menaces to life are—infected abscesses, paraplegia leading to sphincter troubles, pulmonary tuberculosis, and of course any evidence of commencing tuberculous meningitis, such as mental change, incessant vomiting, headache, or unexplained continued fever. In cases where there is great angular curvature a good many die of cardiac lesions. In cervical caries there is some danger of sudden death by displacement.

2. The Prospects of Cure in Ordinary Cases.—Given favourable circumstances, country air, and good treatment, the great majority of children make an excellent recovery, and may indeed become hale and hearty, though there is likely to be some permanent deformity. If the treatment was instituted early, this deformity will not usually be severe; any curvature already present at the commencement of treatment will probably be permanent, but it need not increase. According to Marsh and Watson, from 80 to 90 per cent of cases treated in private practice, and taken early in the pre-curvature stage, recover completely. The treatment will last about two years, and supervision must be exercised for still another year.

The outlook is not always so encouraging. Social position makes a great deal of difference; in towns the children of the poor do badly. Young children are more likely to suffer severely or to die than older ones. Pregnancy as a rule makes matters much worse. A long length of spine affected makes a bad prognosis. Situation in the dorsal spine is less favourable than in the lumbar. Adults seldom make a sound recovery, apart from operation.

Some years ago Tubby and Jones published statistics to show the effect of forcible straightening of the curvature at one sitting; although they have now abandoned the method, it enables one to obtain some insight into the ordinary prognosis in spinal caries. Of 99 cases followed for two and a half years, 44 recovered sufficiently to be able to walk, the curvature being improved or cured; 28 were still recumbent; 12 died; 15 were lost sight of. Further details are furnished: it is stated that 16 were no better; 17 developed abscess; 18 were, or became, paraplegic—of these, 12 recovered and 6 were still afflicted. It is declared that these figures compare well with those obtained by the usual conservative means.

At the New York Orthopedic Hospital, where the children were followed up, on an average, for seven years, of 517 cases, 112 died, 227 were lost sight of, 125 were cured, and 7 still under treatment. The method used, up to 1911, was the Taylor brace; after that date, most of the patients had Hibbs's operation performed.

Notes were made with regard to deformity as follows:—

Of the patients cured, marked increase in the deformity in 50 cases						
"	"	"	slight	"	"	42 "
"	"	"	no	"	"	28 "
No deformity at any time						5 "
In non-operated cases, in 38 out of 77 deformity increased						
"	operated	"	"	10	"	48 "

At Alton, of 920 cases, 674 were arrested, 22 improved, 24 not improved, 68 removed or transferred, and 27 died. That is to say, three-quarters of the patients did well. The treatment was rest, spinal supports, and heliotherapy, and the average stay in hospital 503 days.

Recrudescence in middle life is not very rare.

3. Prognosis in Paraplegic Cases.—All experienced observers agree that cases of paraplegia treated by prolonged rest and weight-extension, preferably in the open air, usually recover the power of walking; but this result may not be obtained for six, or even twelve, months. Probably about 80 per cent of the patients can be improved, if not cured, by this means.

There is a certain residuum in whom conservative measures do not appear to do any good, and where laminectomy may be indicated. It ought not to be resorted to until after long trial of the means already mentioned. Many years ago a few brilliant cures reported by Macewen and Horsley led the profession to overrate the value of operation in these cases.

END-RESULTS OF LAMINECTOMY FOR PARAPLEGIA IN SPINAL CARIES.

Operator	Cases	Died of operation	Died later	Cured	Improved	Relieved but recurred	Not improved
Thorburn -	17	2	1	4	2	5	3
Lloyd -	128	21 (or 16·5 per cent)	36 (or 28 per cent)	37 (or 28 per cent)	16 (or 12·5 per cent)		18 (or 14 per cent)

Lloyd, in 1902, published an account of 128 cases—abstracted from the literature, and therefore possibly unduly favourable. They are not so good, however, as Thorburn's results, drawn from his own personal cases. It will be observed that the mortality, immediate and remote, is about 44 per cent in Lloyd's series, but less than 20 per cent in Thorburn's. Those cured amount to about one-quarter of the whole; with those improved, the proportion is brought up to one-third. It must be remembered that Thorburn and most other surgeons only operate on bad cases, after six months' rest has failed.

4. Prognosis when Psoas Abscess is Present.—As stated elsewhere (*see* PSOAS ABSCESS), cases of psoas abscess recover, die, or become chronic invalids in about equal proportions.

5. Operations to Fix the Spine.—The whole outlook in spinal caries has been revolutionized of late years by the widespread adoption of operations to produce bony ankylosis of the vertebral spinous processes, either by means of an Albee bone-graft, or by Hibbs's plastic operation on the spinous processes. The operation mortality is not more than 3 per cent. Henderson gives the figures for the Mayo clinic as follows:—

Of 81 operations : 0 died.
 42·4 per cent were cured
 45·2 „ „ relieved
 2·7 „ „ no better
 9·5 „ „ died later.

One of the many advantages of the method is the great shortening of time of treatment. The patients were able to return to work, on an average, between twelve and eighteen months after operation. The results in children under twelve are not as good as in adults, and it is not so suitable for cervical caries as for disease of the lumbar or dorsal regions.

Albee himself gives end-results as follows (of the 532 cases concerned, 198 were operated on by himself, and 292 by thirty-one other surgeons):—

Results	Total series, 532 cases		Albee, 198 cases		31 other surgeons, 292 cases	
	No.	Per cent	No.	Per cent	No.	Per cent
Disease arrested - -	449	84.4	184	93	222	76.0
Improved - - -	59	11.0	2	1	59	20.0
Unimproved - - -	9	1.7	0	0	0	0.0
Died soon after operation	9	1.7	6	3	4	1.5
„ long „ „	6	1.1	6	3	8	3.0

My personal experience of this method of treatment is very favourable. Hibbs operated on 210 cases, all followed up from three to seven years. Of these, 157 are cured, 22 are 'doubtful cures', and 31 have died of meningitis, phthisis, miliary tuberculosis, etc.

Summary.—We may take it that good social position and proper treatment commenced early are very important; that the mortality is about 5 per cent; that about 80 per cent recover in early, well-treated cases in favourable surroundings; but that taking the average of all cases, it is probably only about half that do so. The period of treatment is likely to be at least four years. After Albee's operation, the mortality of which is under 3 per cent, 90 per cent are improved, and more than half the patients are cured, and the time under treatment is reduced to six months. Of paraplegic cases, three out of four recover with prolonged rest and extension, but if this fails, laminectomy will relieve or cure about a third of those operated on—the mortality of this operation, immediate and remote, may be 40 per cent..

REFERENCES.—Tubby, *Deformities, including Diseases of Bones and Joints*, vol. ii, 1912; Thorburn, "Spinal Cord", *Burghard's System of Operative Surgery*; Lloyd, *Philadelph. Med. Ann.* 1902, Feb.; Marsh and Watson, *Diseases of the Joints and Spine*, 1910; Humphries and Dalton, *Jour. Amer. Med. Assoc.* 1917, Jan., 282; Henderson, *Surg. Gynecol. and Obst.* 1917, May, 600; Hibbs, *Jour. Amer. Med. Assoc.* 1918, Oct. 22, 1372; Albee, *Orthopedic and Reconstructive Surgery*, 1919, 119. A. Rendle Short.

SPINE, INJURIES OF.—We shall consider the prognosis after injuries of the spine under the following headings: (1) *No evidence of fracture, dislocation, or gross injury of the spinal cord*; (2) *Fractured or dislocated spine, with or without involvement of the cord, apart from operative treatment*; (3) *The value of operative treatment*.

1. Cases without Evidence of Fracture, Dislocation, or Gross Injury of the Spinal Cord.—It is notoriously difficult to arrive at an accurate diagnosis and prognosis in this class of injuries, and much litigation and cross-swearing of medical witnesses is the consequence. "Say it's your back, Bill; the doctors can't never get round your back"; so runs the classical advice given by a workman to his injured mate.

In the great majority of cases, sprains, wrenches, or contusions of the spine, without evidence of bone or nerve injury, improve quickly, and the patient is well in a month or two. There are, however, five groups of symptoms which make the outlook much less favourable.

First, we have to consider the possibility of the onset of *tuberculosis*. Undoubtedly this is a very rare sequel; if a hundred cases of spinal injury were followed up, it is not likely that any would show it; but, on the other hand, patients with caries of the spine do often date it from an injury. The best evidence of the onset of tuberculosis following a trauma will be abscess formation, angular curvature, or skiagraphic evidence of excavation of the bones.

Second, it is quite common for patients, especially workmen seeking compensation, to complain of *persistent stiffness and pain* in the back, often with a tender spot, for months or years after the accident, and the physical examination may reveal nothing at all. It is usually a matter of the greatest difficulty to make a proper distinction between fraud, subconscious exaggeration, fear of being hurt, and genuine pain due to adhesions, in these cases. Sometimes it is rather by detective than medical methods that a correct opinion is arrived at, as for instance by noticing how readily the patient can stoop to pick up anything when he thinks that he is not being observed. When he is lying down on his back, he may be asked to sit up, and also to flex the thighs on the

abdomen, while the surgeon observes whether by these means the normal hollow of the lumbar spine is straightened out. If it is, there cannot be any serious disease present. When a patient is holding his back stiff voluntarily, it can usually be detected by keeping him stooping several minutes with the flat hand over the painful part; there will be a sudden 'give' when the muscle tires.

When the pain and stiffness are due to adhesions, sometimes a cure can be obtained by forcible flexion under an anæsthetic, followed by movements and massage. In many cases recovery is rapid when a financial settlement has been arrived at and the patient has a strong motive to get well.

There are certain other evidences of organic disease, carrying with it of necessity the probability of long, if not permanent, disablement. By firm pressure with oiled fingers, one may be able to detect little nodular thickenings in the deep muscles if they are at fault. Firm prolonged massage helps to cure such cases.

Third, we have to take into account the condition called *traumatic neurasthenia or hysteria*, 'concussion' of the spine, or 'railway spine', with its protean manifestations. This is something more than the persistent pain and stiffness just described; these are usually present and well marked, but in addition there may be a condition of extreme nervous prostration, coming on a few days or weeks after the accident, not usually at once. Sleep is bad, and the patient is very feeble, and lives in terror of paralysis. This is traumatic neurasthenia.

Less commonly, one finds a remarkable simulation of organic disease. There may be areas of complete anæsthesia, having the sock or stocking distribution, and perhaps extreme hyperæsthesia just above the insensitive region. Paralysis, with exaggeration of knee-jerks, may be present, and sometimes retention of urine. This is traumatic hysteria.

The real difficulty is introduced into these cases by the fact that there are a few cases on record of genuine nervous lesions apparently due to an injury to the back, but coming on very slowly afterwards, persisting throughout life, or ending fatally. Several examples are quoted in the third edition of Osler's *Principles and Practice of Medicine*. The following case came under the writer's notice. A gentleman fell from a horse and sustained a blow on the back (not head). For several weeks he was apparently fairly well, though a good deal shaken and neurasthenic; then gradually increasing weakness of the legs came on, and after some months he became unconscious and died. The autopsy showed a chronic cerebral hæmorrhage, apparently by contre-coup. In other recorded cases there has been pachymeningitis, or degeneration of the tracts.

The prognosis in cases of apparent traumatic neurasthenia and hysteria must take these rare sequences into account, and a careful search must be made for the stigmata of organic disease. If any one of the following is present, the prospect of cure is very uncertain—optic atrophy, optic neuritis, *marked* muscular wasting, reaction of degeneration, absent knee-jerks, extensor plantar response, anæsthesia confined to the anatomical distribution of a nerve or spinal segment, incontinence of urine or fæces. Trophic lesions, unless artificial, and ankle-clonus are suspicious of organic disease, but not conclusive.

If evidence of gross changes cannot be found, the patient will almost certainly recover, but it may be a long business. Traumatic hysteria is much more amenable than traumatic neurasthenia. Settlement of any financial or compensation claim usually leads to rapid improvement, and this must not be interpreted to mean that the patient was shamming. Given such settlement, the traumatic neuroses are usually well within a year; but it must be admitted that in a few cases, even where there is no question of compensation, the patient's courage and morale appear to be permanently impaired.

Fourth, there is the condition known as *Kümmell's disease*. This is not an uncommon sequel of a severe injury to the spine. I have seen 5 or 6 cases within the past seven years. It is variously attributed to a rarefying osteitis, or to a compression or shear fracture, of the body of a vertebra. The lower dorsal and upper lumbar regions are most frequently affected. Adults of either sex may be involved. The history is that after the accident, either immediately or after an interval of a few weeks, there is pain in the back, difficulty in sitting up, and the development of a well-marked, though not extreme, angular curvature.

After a few months, firm consolidation appears to take place, and the patient usually gets quite well, except that the deformity persists. It may be diagnosed from tubercle by the definite relation to a severe injury, the skiagraphic findings, and the early and complete recovery.

Fifth, we must take into account so-called *sacro-iliac* strain, affecting adults of either sex. The history of a definite injury may or may not be present. There is persistent pain and rigidity in the lower lumbar region, with a change in the normal lumbar curve of the spine, sometimes in the direction of lordosis, but more often taking the form of a straightening out. The sacro-iliac joints are tender; Kernig's sign may be marked. Pain is aggravated by rolling on to the back. If the displacement is reduced by manipulations and a suitable plaster support given for a couple of months, they can usually be cured.

2. Fracture or Dislocation of the Spine, apart from Operation.—In general, a fracture or dislocation of the spine leads to crushing of the spinal cord, paralysis, anæsthesia, and sphincter troubles. If the injury is high up, death results within a few hours or days, from interference with breathing; if above the fourth cervical vertebra, the patient usually dies on the spot. If the fracture is low down, the patient may linger in a pitiful condition for months, sometimes as long as two or three years, and dies at last of cystitis leading to surgical kidney, bed-sores, or bronchitis. Much depends on the care with which he is looked after. Degenerative changes, sometimes called 'myelitis', appear to take place sooner or later in a spinal cord which has been crushed severely, and these changes may spread up towards the brain.

Burrell has published a record, unfortunately not very well classified, of 244 cases of fractured spine admitted to the Boston City Hospital during forty-two years. He does not furnish separate figures for those patients, 13 per cent of the whole, who displayed no paralysis, nor for the cases operated on. Of the 244 cases, about two-thirds died in hospital. Period when deaths took place:—

Under five days	-	65·7	per cent
Five to ten days	-	8·6	"
Ten to thirty days	-	12·4	"
Later	- - -	13·3	"
		100·0	

Of the 'recoveries' (that is, sent out of hospital still alive), 62 per cent were 'useful', and 38 per cent 'useless'. Therefore, of 100 cases, two-thirds die within a month or two, one-fifth recover sufficiently to get about, and the remainder linger in a helpless condition. More than half of the 'useful' recoveries had never been paralyzed. Apparently about 7 per cent of the 244 patients who were originally paralyzed obtained 'useful' recovery.

Classifying the results according to the region affected:—

Cervical	- - -	85·7	per cent died in hospital
Upper dorsal	- - -	76·7	" " "
Lower dorsal	- - -	56·1	" " "
Lumbar	- - -	50·0	" " "

We turn now from the darker to the more favourable picture, and consider what are the cases that recover.

Concussion of the Cord.—There are undoubtedly patients, of which the writer has seen one, who, with or without a bony injury to the spinal column, are completely paralyzed and anæsthetic up to the umbilicus when first seen, and yet they recover perfectly within a few hours or days. Corner relates five such; in all there was evidence of fracture or dislocation. Some recovered power and sensation within twenty minutes. In a sixth case, the patient, an old man, kicked in the back by a horse, was completely paralyzed and anæsthetic, and died in two days; but at the autopsy there was no sign of injury either to the spine or cord. The patient seen by the writer was admitted with complete loss of power and sensation, coming on instantly at the time of the blow; but he was well enough to walk home in a week! It does not appear to be possible to tell on first seeing the patient whether his paralysis is due to concussion or to gross organic destruction; but if the distributions of the anæsthesia, the paralysis, and the bony injury

do not coincide, there is good hope that there is an element of concussion in the case. If recovery is going to take place, it will do so within a week, and usually there is great improvement within a day or two. Not uncommonly there is a combination of concussion and organic mischief, and recovery will only be partial in consequence.

Fracture or Dislocation of the Cervical Spine used to be considered a necessarily fatal injury; but since the introduction of skiagraphy, many cases have been observed, of which the writer can recollect seeing four, in which recovery took place, though some pain and stiffness of the neck remained. Fritzsche collected from the literature up to 1912 as many as 40 cases of fracture of the odontoid process; 27 died and 13 recovered. Boeckel has furnished a monograph on fractures and dislocations of the neck, showing that the best results are to be obtained, when the cord is not pressed on, by immediate reduction under chloroform, or, better, by continuous extension; if nothing is done there is danger of sudden fatal nipping of the cord. If paralysis is already present, laminectomy is the only hope.

Unilateral dislocation of the neck is particularly favourable in that the cord often escapes involvement, and reduction can generally be effected.

Hæmorrhage into the Spinal Cord or Membranes.—This may come on at once or within a few hours of the accident, and is so far favourable in that some degree of recovery usually occurs, though it may not be complete. Signs suggesting hæmorrhage are: (1) The onset or spread of paralysis after a few hours; (2) The development of the syringomyelia complex—loss of pain and temperature sense whilst tactile persists—indicating a central hæmorrhage; the writer has seen a case; (3) Spasms, cramps, and hyperæsthesia, due to extradural bleeding.

Injury of the Cauda Equina.—Regeneration, sufficient to be of functional value, does not occur in the central nervous system, but it may take place in the cauda equina, either after operation and suturing any divided roots, or spontaneously. Recovery, apart from operation, is not likely to be complete unless the involvement of the roots was very partial. The writer has seen very considerable improvement take place in a month, but not sufficient to make walking possible.

In general terms, then, it may be stated that if recovery is going to occur spontaneously after an injury to the spine with paralysis, there will be marked improvement in a month, and usually in a fortnight. After this, there is little or no hope of further benefit. The most important sign is the degree of muscular wasting. If this is marked, the case is hopeless. Severe trophic lesions, such as bed-sores, are also a bad sign.

It must be borne in mind that, in cases of fractured or dislocated spine in which the cord has escaped, great care must be exercised for months, or the bones may slip and nip it. Burrell relates an instructive example of this.

Total Transverse Lesions.—In these only too-common cases, the prognosis is of course hopeless, but there is a period of improvement, up to a certain point, in most well-cared-for patients. There are three stages:—

i. *Stage of spinal shock*, lasting about three weeks, with absent skin reflexes, flaccid paralysis, and retention with overflow of the bladder.

ii. *Stage of spinal automatism*, well marked in about six weeks, with reflexes active, spastic paralysis, and reflex evacuation of the bladder at intervals.

iii. *Final degenerative stage*, coming on months or years after, due to degeneration of the spinal cord, and leading to death. The reflexes disappear, there is marked wasting, trophic lesions appear and progress, and the bladder becomes paralyzed again and urine dribbles all the time.

3. The Value of Laminectomy.—In the great majority of cases of fractured spine, the cord is completely nipped at the moment of the accident, and nothing will ever restore it. This unfortunate fact dominates the situation. Neither in man nor in animals does functional restoration occur after suture, although Marinesco and others have demonstrated some histological regeneration of fibres. Nevertheless, realizing the hopelessness of the situation in many cases apart from operation, the surgeon is often tempted to employ it as a last chance.

The *mortality* of the operation itself is not high. Thorburn had 3 deaths in 49 cases under his own care, including, however, laminectomy for all sorts of conditions;

he lost none of the 16 patients on whom he operated for injury after the lapse of some weeks. In Lloyd's series of cases from the literature up to 1901, the mortality of the immediate operation was 48 out of 82, or 57 per cent, and of the late operation 11 out of 103, or about 11 per cent. These statistics need correcting; being literature records, they may be too good; but as they go far back, they may be too bad. We may probably conclude that the mortality of the early operation is high, and of the late operation about 5 to 10 per cent. Care must be taken to avoid infection, especially if the patient has incontinence.

STATISTICS OF LAMINECTOMY FOR FRACTURED SPINE (LLOYD, 1909).

	CERVICAL		DORSAL		LUMBAR		SACRAL	
	Imme- diate	Late	Imme- diate	Late	Imme- diate	Late	Imme- diate	Late
Died early - -	21	2	23	5	4	4	0	0
Recovery - -	0	2	4	10	1	6	0	1
Improvement - -	2	1	9	18	1	6	0	3
No improvement - -	0	4	6	16	0	4	0	0
Died later - -	4	3	7	16	0	2	0	0
Total -	27	12	49	65	6	22	0	4

SUMMARY.

	Cases	Died	Recovered	Improved	Not improved	Died later
Immediate operation	82	48	5	12	6	11
Late operation -	103	11	19	28	24	21

When we inquire concerning the *end-results*, the records are not very promising. Thorburn himself operated 5 times within a day or two of the accident, but none of the patients were benefited; he collected records of 200 more cases, without finding evidence that any were improved by the operation. Some, it is true, did get better, but they might equally well have done so without interference.

Lloyd, from his study of the literature, found that out of 83 cases operated on early, only 5 could be described as more or less cured, and 12 improved; it is not possible to say how much better they would have got without operation, but the figures do not compare well with those of the non-operated series, where one-fifth obtained 'useful' recovery. Except in a few urgent cases, such as those with pressure on the cervical cord, early operation is not to be advised.

The late operation, usually a month or six weeks after the accident, gives better results in well-chosen cases. The immediate risk is much less, and as by this time it is evident how much or how little one may expect from nature, any improvement resulting is more certainly due to the operation. Thorburn has performed 16 laminectomies under these circumstances, with 4 cures, 7 improved, and 5 no better. In Lloyd's series, nearly one-fifth are described as having recovered, and one-fourth improved. Unfortunately, mere improvement is not of much use to these patients, unless they are able to stand or walk. In the majority of cases no benefit was conferred.

Nevertheless, it is evident that in a few picked cases considerable good may be done. Exactly which these cases are is shown less by the statistics than by experience and by a few isolated reports. Marburg and Ranzi have recently reported the results of 142 cases of spinal-cord injury operated on in von Eiselsberg's clinic in Vienna. This includes a certain number of gunshot wounds. Nearly all were late operations. The usual indications were positive *x-ray* evidence that the cord was being pressed on by displaced bone

or a projectile, or a partial crush-through of the cord that did not improve after two months.

Of 142 cases, 14 died shortly after laminectomy (5 from pneumonia) = 10 per cent
" " 28 " subsequently (nephritis, bed-sores, etc.).
" " 41 showed definite improvement = 30 ,,

Laminectomy may do good in the following classes :—

a. Fracture or dislocation of the neck with pressure on the cord, where death stares the patient in the face.

b. Pressure on the cauda equina, because in the nerve-roots regeneration is possible. Thorburn advises delay for six weeks to see what spontaneous recovery will do, and quotes a case of Tuffier's, in which complete cure followed laminectomy and suturing.

c. Depressed fracture of a lamina, which can be removed. Schede obtained complete recovery in such a case, although when first seen the patient was quite paralyzed and anæsthetic. Other surgeons have not had such happy results.

d. Cases of hæmorrhage into the membranes.

e. Cases in which retention, or exaggeration of the reflexes, shows that the functional continuity of the cord is not destroyed, but that it may be suffering injurious pressure.

f. Cases in which the skiagram shows a bony deformity or a foreign body, encroaching on the spinal canal. This warrants exploration even in the presence of complete loss of reflexes.

4. **Gunshot and Other Wounds of the Cord** (see GUNSHOT WOUNDS, p. 237).

REFERENCES.—Lloyd, *Jour. Amer. Med. Assoc.* 1901, 1014, 1111, 1247; Thorburn, "Injuries of the Spine", *Burghard's System of Operative Surgery*; Fritzsche, *Deut. Zeits. f. Chir.* 1912, 7; Boeckel, *Rev. de Chir.* 1911, 285; Corner, *Lancet*, 1906, ii, 784; Burrell, *Ann. of Surg.* 1905, xlii, 481; McKendrick, *Injuries of the Back*, 1916; Marburg and Ranzi, *Arch. f. klin. Chir.* 1918, cxl, 71.

A. Rendle Short.

SPINE, TUMOURS OF.—We shall include under this heading growths of the vertebral column, and also of the spinal cord.

Tumours of the Vertebral Column.—Growths arising in the bony spine are almost invariably malignant, either primary sarcoma or secondary carcinoma. At first they are likely to be confused with an early case of tuberculosis of the spine, presenting only pain and localized rigidity, without abscess formation or angular deformity. The skiagram may be helpful, and especially a history of carcinoma elsewhere.

When the diagnosis is established, the prognosis is practically hopeless. After a few months of great pain and helplessness, the patients die. The cord may eventually be pressed on.

Hydatid disease of the lumbar vertebræ may simulate tumour, and in this case a successful result may follow operation. Of five cases of hydatid disease of the spine treated by operation at the Queen Square Hospital, all have done well.

Tumours of the Spinal Cord.—The diagnosis of these cases usually rests upon progressive signs of paralysis, anæsthesia, and sphincter trouble due to pressure on the cord, associated with severe pain, and in many cases the symptoms are at first unilateral. As it is difficult or impossible to make a clinical distinction between the signs of spinal-cord tumour and those of localized or diffuse spinal serous meningitis, these are taken together.

Apart from operation, the cases are always fatal within a few years. The average duration of life is said to be sixteen months (Starr) to two years (D. Armour), but a few go on for several years. Rarely, iodides improve matters somewhat. There is generally a steady progress from root pains to pressure on the cord, then to sphincter troubles, cystitis, bed-sores, etc.

Treatment by Operation.—Although tumours of the spinal cord are not so common as tumours of the brain, the results of treatment are much more satisfactory. All observers agree that sarcoma is the type of growth most frequently met with, but if the microscopical diagnosis is to be relied upon, sarcoma in this situation must be of a very benign type, because recurrence is the exception, not the rule.

The *operation mortality* is not very serious at the present day. The general death-rate of the operation of laminectomy for all causes is given by Thorburn, as the result of 49 cases in his own practice, as 6 per cent.

The following table gives the mortality of laminectomy for tumour :—

TUMOURS OF THE SPINAL CORD. OPERATION MORTALITY.

Reporter	Cases	Deaths
Thorburn (personal) - - -	6	0
Von Eiselsberg and Ranzi - -	17	2
Hunt and Woolsey - - -	7	1
Harte (from the literature) - -	92	26
Potel and Veau (literature) -	55	19
Sargent - - - - -	27	5
Elsberg—extramedullary growths -	31	2
„ cauda equina growths -	11	2
„ extradural growths -	7	1
„ intramedullary growths -	18	2
Total -	271	60

When followed for a long period, 17 more of Harte's series died, but his figures could probably be improved upon at the present day ; the true mortality may be between 10 and 20 per cent. About half the cases seen are suitable for removal ; of the remainder, some growths start in bone, others are very extensive, or the cord is already destroyed. Elsberg succeeded in removing 39 out of 67 operated on.

The *end-results*, compared with those of cerebral tumour, are very satisfactory. R. T. Williamson, by picking successful cases out of the literature, is able to give details of 51 patients, 17 of them having had a sarcomatous tumour, in whom practically complete recovery took place ; that is, they were all able to walk, but a few still showed some spasticity or ataxia.

The following table gives the end-results in a few small series :—

TUMOURS OF THE SPINAL CORD, END-RESULTS OF OPERATION.

Reporter	Cases followed	Cured	Improved	Not improved	Recurred
Thorburn - - -	6	5	1	0	0
Von Eiselsberg and Ranzi -	10	3	6	1	0
Hunt and Woolsey - -	5	3	0	0	2
Harte (from literature) -	49	29	17	3	?
Sargent—					
encapsulated intrathecal					
extramedullary - -	12	11	0	1	0
diffuse ditto - -	3	0	0	2	1
extrathecal - -	4	0	3	1	0
intramedullary - -	3	0	2	0	1
Total	92	51	29	8	4

Thorburn records 6 cases from his own practice, of which 5 were well enough to go back to work.

In von Eiselsberg's series, in 3 cases no tumour was found ; 2 of these were improved, and 1 was not improved.

Hunt and Woolsey relate 5 cases ; 1 recurred and had a second operation four years later, but has since remained well for years ; another recurred a year after operation. The other 3 were well three to five years after operation.

Harte's series, drawn from a study of the literature up to 1905, does not show how long the cases were followed, nor how many recurred, but he states that many cases, even of sarcoma, were well years afterwards. Out of 37 patients with sarcomatous tumours of the cord, 20 died, 8 were cured, 7 improved, and 2 no better. In 12 of his cases only adhesions or cysts were found.]

Sargent shows that there is a great difference in the outlook in different types and situations of the growth. The favourable one is encapsulated intrathecal extramedullary tumour, which is a fibroma or endothelioma (including psammoma) in most cases. The other varieties are all sarcoma, and the prognosis is not good, as the table shows.

We may conclude then, that about half the cases of tumour of the spinal cord are operable; that the operation mortality is about 10 to 20 per cent; of patients recovering from the operation, two-thirds are cured, and only about one in ten fails to benefit or relapses; and that the most promising type is the encapsulated intrathecal extramedullary tumour.

REFERENCES.—R. T. Williamson, *Diseases of the Spinal Cord*, 1911; Thorburn, "Spinal Cord"; Burghard's *System of Operative Surgery*; von Eiselsberg and Ranzi, *Arch. f. klin. Chir.* 1913, 309; Hunt and Woolsey, *Ann. of Surg.* 1910, lii, 289; Harte, *Ann. of Surg.* 1905, xlii, 524; Sargent, *Brit. Med. Jour.* 1920, i, 37; Elsberg, *Amer. Jour. Med. Sci.* 1920, Feb., 194. *A. Rendle Short.*

SPLEEN, INJURIES OF.—(See ABDOMINAL INJURIES; GUNSHOT WOUNDS.)

SPLENIC ANÆMIA.—(See ANÆMIA, SPLENIC.)

SPLENOMEGALIC POLYCYTHÆMIA.—(See POLYCYTHÆMIA.)

SPRAINS.—(See JOINTS, INJURIES OF.)

SPRUE.—Sprue is a very chronic disease as a rule, with great tendency to relapse after apparent cure, so it is difficult to obtain accurate figures regarding its mortality. An analysis of 50 cases in the Calcutta European Hospital showed only 2 discharged as 'cured', of whom at least one relapsed. Only 6 died in hospital, 5 of whom were between the fifth and twelfth month of the disease out of 18 in that stage, which is therefore the most deadly period. Only 1 of 12 cases of over one year's duration died in hospital, so the more chronic cases have a better prognosis. None died during the first six months of the disease. On the other hand, only 3 of the 45 cases were much better when discharged, while 26, or 57·7 per cent, were no better, mostly after prolonged treatment, so had little chance of recovery, and the prognosis of the disease is therefore very grave. Many patients, who return to the tropics after having been 'cured' by santonin and other treatment during a prolonged stay in Europe, soon relapse, and some die of the disease. The most deadly complication is pernicious anæmia, which may carry off the patient within a few weeks.

Unfavourable signs are extreme emaciation, advanced anæmia, increased frequency of the stools maintained over a long period, and extreme soreness of the mouth interfering with feeding. Too early, and especially sudden, great changes in the diet may cause a relapse or precipitate a fatal termination.

Steady gain in weight and improvement in the consistency and colour of the stools are the most favourable signs; but extreme caution is necessary in adding to the diet. No drug has any specific action in the disease, the effect of yellow santonin being very temporary when not accompanied by change to a cool and bracing climate, which itself has the greatest curative action. In Porto Rico Ashford in 1917 reported on 62 typical sprue cases treated by dietetic methods with 36 (58 per cent) cured and remaining well for six months and upwards, 16 improved, 4 not improved and 6 (9·7 per cent) died. Later Michel reported on 62 cases treated with Ashford's monilia vaccine with 49 (79 per cent) cured, 12 improved, and 1 died. Rogers with his autogenous oral streptococcal vaccine has recorded 44 cases with 21 cures, 18 of whom remained well for over a year, 13 much improved, 9 improved, and 1 died of cirrhosis of the liver after recovery from sprue. Among 20 cases followed up for over a year, 18 (90 per cent) were cured and 2 improved, and Nicholls has confirmed the value of this vaccine in Ceylon. The prognosis of sprue appears to have been considerably improved by these new methods of treatment.

Leonard Rogers.

STATUS LYMPHATICUS.—(See ANÆSTHETICS, p. 37.)

STILL'S DISEASE.—(See ARTHRITIS DEFORMANS.)

STOMACH, GUNSHOT WOUNDS OF.—(See GUNSHOT WOUNDS.)

STOMACH, MEDICAL AFFECTIONS OF.

Acute Gastritis.—The prognosis depends very greatly on the cause and intensity of the catarrh. If due to microbic causes, the gastric symptoms may only be the local manifestations of a general disease such as enteric fever.

Uncomplicated acute gastric catarrh is generally well in a few days, but may last for a week or longer.

Toxic Gastritis, i.e., the gastritis produced by the ingestion of various poisonous substances such as concentrated acids and alkalis, arsenic, phosphorus, perchloride of mercury, and so on.—The prognosis in each case depends on the amount taken, the concentration, and the particular poisonous action of each substance. A fatal result may occur in two or three hours, the patient becoming cyanosed, with embarrassed respiration, and dying with convulsions, suffocation, or collapse. On the other hand, he may die in a few days' time from perforation and peritonitis, or later on from remote effects such as stenosis of the œsophagus, stomach, or pylorus. Lastly, he may die from the poisonous effects of the particular substance taken.

Chronic Gastritis.—Before any satisfactory prognosis can be given in chronic gastritis it is necessary that a certain diagnosis should have been made, and the possibility of malignancy or pernicious anæmia excluded. *Per se* it may last for an indefinite number of years; but some cases are complicated by subsequent carcinoma of the organ. In very rare cases a tumour may be felt in simple cirrhosis of the stomach, death eventually being due to asthenia following emaciation and anæmia.

Diffuse Phlegmonous Gastritis is almost certainly always fatal, the course of the disease being less than a week.

Membranous Gastritis, being almost always secondary to some other severe illness, the prognosis depends on that of the primary disease, though not infrequently this complication is a terminal lesion.

Carcinoma.—The prognosis depends on the type of the growth, its rate of progress, tendency to ulceration, and the rapidity with which secondary deposits arise. Unless the tumour can be removed by surgical means, death is inevitable. This in very rare cases may be delayed as long as four years, but in the great majority of cases is very much less. An average duration of life after the disease is first diagnosed is about seven or eight months. In very exceptional cases the patient may increase in weight after a preliminary wasting. In one of the writer's cases, a temporary gain in weight of eleven pounds in sixteen days occurred in an emaciated woman the subject of carcinoma. The intensity of the pain is no guide to the prognosis, since it bears no relation to the rate of extension or size of the growth.

It is unusual for hæmatemesis to be the cause of death in carcinoma of the stomach, though this may arise from deep ulceration, or even from involvement of the spleen. The onset of complications due to the invasion of other organs by secondary growths frequently hastens the end. Among the most important of these are jaundice from involvement of the liver or of the glands in the transverse fissure, and ascites from involvement of the peritoneum. Perforation may give rise to general peritonitis, according to some authors, in as many as 5 to 7 per cent of cases. If the growth is surrounded by adhesions, an abscess, sometimes subphrenic, is responsible for the fatal result.

Congenital Hypertrophy of the Pylorus (*see also* PYLORUS, CONGENITAL STENOSIS OF).—About 50 per cent recover without subsequent complications. With an earlier recognition of the disease, the proportion of recoveries will probably be much greater. In Still's series of 27 cases about 50 per cent recovered, 8 after operation and 6 after medical treatment, which included daily gastric lavage with a weak alkaline solution. If definite loss of weight continues after a few days of medical treatment, the prognosis is grave unless the child is submitted to surgical operation. If symptoms continue and loss of weight is rapid, delay is dangerous.

Ulcer.—Correct statistics in connection with gastric ulcer are almost impossible to obtain, because of the difficulty of a certain diagnosis. This applies not only to observations made during life, but also to statistical records based on post-mortem investigations, because cicatrices of small ulcers which have healed are readily overlooked, and very slight ulceration may have healed without leaving any scar.

Speaking generally, the prognosis of acute gastric ulcer treated by thorough and

prolonged medical treatment is satisfactory. Statistics vary, however, within somewhat wide limits. Leube gave the death-rate as 2.4 per cent in 424 cases, but eventually he brought down his mortality to 0.3 per cent. Lebert gave the mortality as 10 per cent, J. W. Russel as 6.4 per cent, Bulstrode as 18 per cent, Fleiner as 0 per cent in 300 cases, and Weitrand as 0 per cent in 133 cases. The more recent the case, the better the prognosis. Possibly about 6 to 7 per cent of cases perforate into the peritoneal cavity, but the prognosis of this calamity has enormously improved within recent years, owing to the advance of surgical technique. The position of the ulcer modifies the prognosis, since ulcer on the anterior wall is more liable to perforate. Local abscess, subphrenic or elsewhere, may lead to death by exhaustion, pyæmia, or pylephlebitis. In rare cases, the abscess bursts into the lung, pleura, or pericardium. Probably less than 3 per cent of the cases succumb from hæmorrhage, and another 5 to 6 per cent from other causes, including inanition, secondary mechanical deformities, and carcinoma. Debove and Remond found that pulmonary tuberculosis supervened in 20 per cent out of 100 cases investigated. Chronic ulcer is responsible for about 70 per cent of cases of carcinoma of the stomach. The mortality from hæmorrhage in Lenhartz's series of 295 cases was 1 per cent, and in Ewald's 652 cases 1.2 per cent. Spriggs found that the prognosis with reference both to life and recurrence of hæmorrhage was more favourable in patients treated by Lenhartz's method than in those treated by nutrient and saline enemata followed by a graduated milk diet. Relapse is very frequent, and probably occurs in not much less than 30 per cent. Greenough and Joslin found that while 82 per cent of the cases of gastric ulcer were discharged cured or relieved from the Massachusetts General Hospital, only 40 per cent remained well. After surgical treatment, as after medical, relapse is not infrequent, but the tendency to relapse after any method of treatment is less after the age of thirty than before. Although it is unusual for a patient to die from a single attack of hæmorrhage, this occasionally occurs, sometimes so rapidly that the patient succumbs before vomiting takes place. According to Spriggs, the mortality of any large series of cases operated on for hæmorrhage is greater than it is in a similar series not operated on.

About 50 per cent of the cases are permanently cured. Anæmia from any cause retards the healing of an ulcer, and a patient with a healed ulcer is always liable to relapse as long as anæmia persists. The percentage of cases of cancer of the stomach which owe their origin to previous ulceration varies in different statistics from 2.3 per cent up to 9 per cent.

Syphilis of the Stomach.—This affection may very closely simulate gastric ulcer or malignant growth, and may occur in the form of syphilitic ulcer, gumma, pyloric stenosis, or diffuse cirrhosis of the stomach. The prognosis, therefore, very largely depends on a correct diagnosis. If this is made early, before the patient is suffering from excessive debility owing to the mechanical effects of the tumour, or from dense adhesions or peritonitis, the prognosis is decidedly favourable under brisk antisymphilitic treatment. Death has, however, occurred from perforation of a broken-down gumma. With dense adhesions or formation of scar tissue, surgical treatment may be necessary. Profuse hæmorrhage may very exceptionally arise.

Acute Dilatation.—This may cause death in a few hours, with pain, anuria, severe symptoms of collapse, associated with a very copious and rapid secretion into the stomach. Vomiting begins and generally persists throughout the attack. Cessation of vomiting is not, however, always a favourable indication, as in some cases there is an intermission due apparently to a temporary cessation of secretion, while in other cases it ceases some little time before death owing to the weakness of the diaphragm and abdominal muscles. A fatal result is not uncommon in spite of energetic treatment and gastric lavage. Sudden dilatation, arising from injudicious feeding during convalescence from prolonged exhausting diseases such as typhoid fever, may lead to immediate death.

Chronic Dilatation.—The outlook depends very much on the cause, the general health of the patient, and the length of time the trouble has existed before treatment is adopted. In atonic dilatation, the course of the illness is frequently very prolonged, running into years, very frequently with incomplete restitution of the normal size of the viscus at the end of lengthy and careful treatment. With mechanical obstruction prognosis is more hopeful, if early surgical treatment is available. Severe forms of gastric dilatation may be associated with tetany, which, if well marked, is of serious significance. This condition

has, however, been treated quite successfully by gastro-enterostomy, with subsequent cure of the patient. (With reference to the prognosis of coincident acidosis, see ACIDOSIS.)

J. R. Charles.

STOMACH, SURGICAL AFFECTIONS OF THE.

Gastric Ulcer.—Our conception of 'gastric ulcer' has entirely changed in recent years; formerly considered easy of diagnosis, it is now known to be difficult, even in long-standing cases. For this reason the prognosis of cases not verified by operation is entirely a matter of conjecture.

Two distinct lesions are included under the term gastric ulcer—the acute ulcer, frequently multiple, and the indurated chronic ulcer, usually single.

Owing to the extension of surgical activity in the upper abdomen, we now know that symptoms which formerly were considered pathognomonic of gastric ulcer often owe their origin to extra-gastric causes such as disease of the gall-bladder or appendix, and are entirely removed by treating these.

That chronic gastric ulcer is a serious disease carrying with it a very considerable mortality is now becoming well known.

The results of the medical treatment of patients presenting the symptoms of chronic gastric ulcer have been investigated by several. Among the earliest figures are those given by Bulstrode,¹ who compiled statistics of all the cases of 'gastric ulcer' admitted into the London Hospital from January, 1897, to August, 1902. These numbered 500, 402 women and 98 men. Forty-two per cent had had previous attacks. The death-rate was 18 per cent: 10 per cent from perforation, $2\frac{1}{2}$ per cent from hæmatemesis, $5\frac{1}{2}$ per cent from other causes. These figures did not include late results such as pyloric stenosis, hour-glass contractions, etc. That they are unreliable, and the mortality-rate much too low, is evident from the sex relationship, 402 women and 98 men. Of the 460 cases of gastric ulcer upon whom I have operated to December 1, 1920, 291 were males. This is in accord with the experience of other surgeons. The conditions which mimic chronic gastric ulcer are more common in the female sex, and rarely fatal.

Habershon's² figures give a more correct idea of the death-rate in cases of chronic gastric ulcer medically treated. Of 60 cases in private practice, there were 24 deaths, 16 males (6 perforation, 7 hæmatemesis, 3 exhaustion) and 8 females (5 perforation, 3 hæmatemesis).

MacNevin and Herrick's³ figures are instructive. Among 55 fatal cases of gastric ulcer examined post mortem, 25 had died of hæmatemesis (19 males, 6 females); 30 of perforation (8 males, 22 females).

Greenhough and Joslin⁴ published the results of the medical treatment of 187 cases; the initial mortality was 8 per cent. After five years, 115 patients could be traced: 57 had had recurrence, and 15 had died of gastric disease.

Figures based on the medical diagnosis of gastric ulcer, although minimizing the real risks, show very strongly the futility of medical treatment in the majority of the cases.

It is evident from the discrepancy between the sex distribution in the medical and surgical statistics that there are two distinct conditions: one more common in women, in which acute ulceration followed by perforation may occur; the other more frequent in men, in which the immediate cause of death is not uncommonly hæmatemesis. In this group, perforation is unusual, but the subsequent development of carcinoma is a common complication.

The cases formerly diagnosed gastric ulcer in young women are often examples of extra-gastric disease with, in many cases, acute gastritis or ulcers the result of septic infection. The relation between the two groups is at present obscure. Careful medical treatment is successful, if the condition causing the gastric disturbance—septic teeth or chronic constipation—can be dealt with; but if disease of the gall-bladder or the appendix is responsible, operation is necessary.

In chronic gastric ulcer, in addition to the dangers from hæmorrhage, perforation, and malnutrition the result of stricture, there is the appreciable risk of the development of carcinoma. Considerable difference of opinion exists with regard to the frequency with which this occurs. Many physicians disbelieve in this relationship. To the surgeon, the question seems to be indisputable.

The most widely-quoted figures are those of Wilson and MacCarty,⁵ obtained as a result of their examination of specimens removed by operation in the Mayo clinic. In 109 out of 153 cases (71 per cent) there was evidence that malignant disease had supervened on chronic gastric ulcer. In reviewing the specimens in 1914, Wilson and McDowell⁶ concluded that gastric cancer rarely develops except at the site of a previous ulcerative lesion.

Moynihan⁷ has found that in 25 to 30 per cent of carcinoma of stomach removed by operation, the claim that the malignant change is imposed upon a simple one appears on pathological grounds to be irrefutable. In 18 out of 65 removed by the writer to Dec. 1, 1920, there was definite microscopic evidence that the malignant disease supervened on a simple ulcer.

On the other hand, in 163 consecutive cases in which the writer removed chronic gastric ulcers, diagnosed at operation as simple, serial sections were examined microscopically, and in 9 there was definite evidence of malignant disease.

Burk⁸ records 24 cases of excision of chronic gastric ulcers, in 6 of which microscopic examination revealed early malignancy.

Looking at the subject from the clinical standpoint, out of 280 cases personally operated upon, to December, 1920, 90 only were women; this fact is suggestive. In 45 per cent of the cases I obtained a history of gastric disease on which I should base the diagnosis of chronic gastric ulcer, extending over more than four years.

Chas. H. Mayo⁹ found a history of ulcer in "well over 40 per cent", Sir Berkeley Moynihan⁷ "in more than half the cases", and Pauchet¹⁰ puts it as high as 75 per cent. *At the present time, chronic gastric ulcer is the most important and the only known factor in the 'causation' of carcinoma of the stomach.*

Thorough medical treatment after removal of septic foci during the first attack of gastric symptoms can be expected to result in cure in 30 to 40 per cent of the cases. If relapse occurs it is obvious that the exciting cause is beyond medical assistance. If chronic ulcer has developed, medical treatment appears to be a failure in every case.

Perforation.—Prognosis depends upon the time at which operation is carried out. If within twenty-four hours, the death-rate should certainly be below 10 per cent. The older figures, which are widely quoted, are much too high. Gross and Gross¹¹ found the death-rate of operation in collected cases within the first twenty-four hours to be 50 per cent, and within the first twelve 25 per cent, a figure which agrees closely with those given by Brunner;¹² these closely correspond with the personal figures of Miles,¹³ in 1906: 19 cases within twelve hours of operation, 26.3 per cent mortality; 9 cases between twelve and twenty-four hours, 44.4 per cent mortality.

Sinclair Kirk¹⁴ has recorded a series of 11 cases operated on, 10 before the twelfth hour, and 1 at twenty hours, with recovery in all.

Of 16 cases upon whom I have operated within the first twenty-four hours, all recovered. On the other hand, in 28 cases over this period, there were 14 deaths.

The immediate result of operation in the survivors is excellent, but a certain number complain later of dyspeptic symptoms similar to those from which the majority suffered before perforation. There is, however, considerable difference of opinion with regard to this. Hale White¹⁵ said: "Judging from our results at Guy's Hospital, it appears that patients who survive an operation for perforated gastric ulcer do so well that a gastrojejunostomy is quite unnecessary." This is, however, not the experience of surgeons if the word 'operation' is used instead of gastrojejunostomy.

Paterson found that 23 per cent of patients relapsed within a year of operation.

It is obvious that the ulcer which perforates is a chronic one unless the continuance of the symptoms depends upon extra-gastric causes.

If the ulcer which perforates is a chronic one, the appropriate operative procedure should be carried out if the condition of the patient permits.

Hæmatemesis.—Dr. Cecil Wall¹⁶ found that 6 per cent of the men and 12 per cent of the women who were admitted to the London Hospital suffering from chronic gastric ulcer, diagnosed clinically, died of this complication. The death-rate is far in excess of this, for included are many cases which were certainly not chronic gastric ulcer. This is shown by all reports of post-mortems, while hæmatemesis is undoubtedly more common in women than in men. Thus MacNevin and Herrick found hæmatemesis to be the cause

of death in 25 out of 55 cases of chronic gastric ulcer which came to post-mortem. Of these, 19 were males, and of the women, all except one were over thirty. These figures correspond to my operative experience that chronic gastric ulcer is twice as common in men as in women.

The prognosis of the hæmatemesis of young women is extremely good: the death-rate is less than 5 per cent. I believe that life cannot be saved in this condition by operation. The bleeding often takes place from many foci, and continues unchecked in spite of gastrojejunostomy.

I believe the death-rate from hæmatemesis in chronic gastric ulcer is over 40 per cent. If treated surgically as soon as possible after the first hæmorrhage, the outlook is good. Operation consists in directly controlling the source of hæmorrhage by destruction of the ulcer or tying the vessels on either side, combined with gastrojejunostomy if necessary.

I have treated 54 cases in this way with 4 deaths. On the other hand, death occurred in three patients whom I had seen and who had refused operation, recurrence of bleeding proving fatal.

Operation as soon as possible after the first hæmorrhage—this is usually within twenty-four hours in all cases of chronic gastric ulcer—will render the prognosis favourable.

Chronic Gastric Ulcer.—There is still a difference of opinion with regard to the exact form surgical treatment should take. The immediate risk, if the operation is carried out by one skilled in upper abdominal surgery, is a small one. Up to December 1, 1920, I had operated upon 416 cases of chronic gastric ulcer uncomplicated by perforation, with 16 deaths.

The following were the operations performed :—

Excision alone : 9 cases, 1 death.

Excision and gastrojejunostomy : 26 cases, 1 death (this patient had urethral stricture and cystitis and died a month later from this cause).

Partial gastrectomy : 112 cases, 9 deaths (1 from acute gastric dilatation, 2 from pulmonary embolism, 4 from pneumonia, in 2 no cause was discovered post mortem). These cases treated by partial gastrectomy were all patients in whom the ulcer had perforated, its floor being formed of pancreas or liver, or in which there were suspicions of malignancy.

Gastrojejunostomy alone : 269 cases, 5 deaths (3 from pulmonary complications, 1 from leakage ten days after operation for hæmatemesis, and one from hæmatemesis).

Other figures are : Moynihan¹⁷, 235 cases (since 1909), death-rate 2·9 per cent ; C. H. Mayo¹⁸, 638 cases, death-rate 3·2 per cent.

It will be seen in operation the death-rate for chronic gastric ulcer, including those operated for hæmatemesis, is between 2·5 and 4 per cent.

The remote results will compare favourably with those of any other major operation. I recently published the following figures :—¹⁹

The cases operated upon up to December, 1917, number 310 with a mortality of 11. These figures include all ulcers treated by operation, except for acute perforation. The operations are as follows :—

Excision alone : 9 cases, 1 death from subphrenic abscess. All except 2 required subsequent operation for recurrence of the ulcer.

Partial gastrectomy : 52 cases, 4 deaths (acute dilatation of the stomach, pulmonary embolism, pneumonia ; no cause found post mortem). All except 2 are quite well and eat ordinary food in the usual quantity.

Gastrojejunostomy and excision : 25 cases ; 1 death from urethral stricture and pyelitis a month later. I have been able to trace 22. Twenty are quite well. Two have indefinite complaints, but are much better.

Gastrojejunostomy alone : 224 cases ; 5 deaths (3 from pulmonary complications, 1 from leakage ten days after operation for hæmatemesis, and 1 from hæmatemesis). I have been able to keep 187 under observation ; 162 have remained perfectly well. Three died of carcinoma of the stomach.

Of the 310 cases, 220 have remained quite well for over two years, 75 per cent of those operated upon.

While gastrojejunostomy, combined with general abdominal exploration and dealing with other diseased organs, is curative in a large percentage of cases, all ulcers that have perforated and are adherent to neighbouring organs, indurated ulcers on the lesser curvature, and all in which there is a suspicion of malignancy, should be treated by partial

gastrectomy. If operation is carried out on these lines, at least 85 per cent will be cured at a risk of less than 4 per cent.

In 86 cases of hour-glass stomach operated upon by the writer, the following were the operations carried out :—

Single gastrojejunostomy : 49 cases, 3 deaths.

Double gastrojejunostomy : 5 cases, no death.

Modified Roux's operation : 2 cases, no death.

Partial gastrectomy : 55 cases, 3 deaths.

All but one of those operated upon over two years ago are quite well.

Duodenal Ulcer.—In duodenal ulcer, medical treatment after the first attack is not only futile but dangerous. Delay is not to be countenanced ; the danger of perforation is great, and frequently occurs between attacks when the patient is free from symptoms and apparently well. Perforation of a chronic gastric ulcer is unusual, of a chronic duodenal one frequent. Perforation of an acute duodenal ulcer is rare.

The same sex predominance is seen in perforation as in the cases operated on before this has taken place. Of 248 cases of perforated gastric ulcer operated on in the London Hospital in the ten years ending December, 1919, 99 were women. On the other hand, among 218 cases of perforation of duodenal ulcers admitted during the same period, only 17 were women.

That the danger of perforation in chronic duodenal ulcer is greater than in gastric is evidenced from the figures given by Gruber²⁰ from post-mortem examination. He found that while 17 per cent of the cases of duodenal ulcer had died of perforation, only 5.6 per cent of the gastrics succumbed, and gives the death-rate of duodenal ulcer as 25.5 per cent, of gastric ulcer 9.8 per cent.

Küttner²¹ states that the prognosis of duodenal is decidedly less favourable than that of gastric ulcer on account of the frequency of perforation and hæmorrhage. He quotes statistics of post-mortems at Hamburg showing that when duodenal ulcer was found post mortem it was the cause of death in 40 per cent.

Hæmorrhage is the same lethal complication as in cases of chronic gastric ulcer.

While malignant disease frequently supervenes in cases of chronic gastric ulcer, this change is rare in duodenal ulcer.

Up to Dec. 1, 1920, out of 537 cases of chronic duodenal ulcer personally operated on before perforation, in 1 only had malignant disease supervened after a history pointing to chronic duodenal ulcer extending over many years. Moynihan²² also has recorded an example in which malignancy supervened after ten years. Jefferson,²³ in recording a case in which he considered carcinoma followed on chronic ulcer, reviewed the previously reported instances of this complication. He was only able to obtain 30, and in a large number of these the evidence is far from conclusive.

No case has been recorded of carcinoma of the duodenum arising after gastrojejunostomy.

Perforation.—If operation is carried out within the first twenty-four hours, the prognosis is extremely good.

Sherren : 46 cases of perforation with 30 recoveries. Of 24 operated upon within the first twenty-four hours, all recovered except 2, one of whom was suffering from advanced genito-urinary and pulmonary tuberculosis. The other was a patient in whom fat necrosis²⁴ was found at operation, and a perforated ulcer was overlooked.

Mitchell²⁵ has recorded 16 cases operated upon without a death. Of these, 11 were operated upon within twelve hours of perforation, 6 within five hours, 1 each at seventeen and a half, eighteen, twenty-five, thirty-six, and forty-nine hours after perforation.

Struthers²⁶ quotes 24 cases with 19 recoveries.

It is evident that operation can be carried out within the first twenty-four hours with a death-rate of less than 5 per cent. In all cases in which a chronic ulcer perforates, gastrojejunostomy should be done at the time of closure of the perforation. This I did in 22 of my cases, only 1 of whom died, the patient mentioned above. In the cases in which this was not carried out, I have since had to perform it for recurrence of symptoms. In addition, I have had to treat surgically 15 cases after perforation of a chronic ulcer had been closed by other surgeons and recurrence of symptoms had taken place

The immediate risk of operation in cases of non-perforating duodenal ulcer is small. Moynihan²⁷ reports 563 cases operated upon, with 3 deaths.

Sherren : 537 cases, with 10 deaths (3 of these occurred among the 41 patients in whom the operation was an emergency one on account of hæmorrhage ; one of these died from a continuance of hæmorrhage, another from pulmonary embolism, and in the third his abdominal wall broke down twelve days later and he died of pneumonia after re-suturing) ; 3 died of bronchopneumonia ; 1 died of pulmonary embolism ; in 1 no cause could be discovered at the post-mortem ; 1 died of hæmatemesis ; 1 died of regurgitant vomiting which developed ten days after operation.

The writer in his Hunterian Lecture reviewed 389 cases operated on over two years ; He was able to trace 348 : 318 remain perfectly well, or were well until death from another cause more than two years after operation ; 19 are known to have developed a gastro-jejunal or jejunal ulcer ; 18 of these were operated upon, 4 died ; 10 are quite well three to nine years later, 1 is improved, 1 lost sight of, and 2 have been operated on less than two years.

In Moynihan's cases, 82.78 per cent are recorded as cured, and 7 per cent improved.

The treatment of chronic duodenal ulcer by gastrojejunostomy on modern lines should lead to cure in at least 92 per cent of the cases.

It is important to see that treatment is carried out for at least three months after operation.

The complication most to be feared after gastrojejunostomy is jejunal ulceration. This may occur at the suture line, when it is termed gastrojejunal, or in the jejunum not far removed from it, the true peptic jejunal ulcer. The former condition is preventable ; it is due to the use of unabsorbable sutures. Nothing but catgut should be used in doing the anastomosis. The true jejunal ulcer is situated in most instances on the anterior surface of the distal limb of the jejunum, about 1 in. from the anastomosis.

The question of the actual exciting cause of jejunal ulceration is uncertain, but it has undoubtedly an association with hyperchlorhydria, is most often met with in males, and follows operation for chronic duodenal much more frequently than those for chronic gastric ulcer. All the thirteen true jejunal ulcers that the writer has operated on were males, and in all except one the gastrojejunostomy had been carried out for chronic duodenal ulcer.

As the probable cause of jejunal ulceration is similar to that of the ulcer for which the operation is carried out, it is less likely to occur if careful search is made at the time of the primary operation for other foci of disease in the abdomen, particularly in the appendix and gall-bladder. The writer has seen instances in which a jejunal ulcer developed at the site of a hæmatoma, the result of clamp pressure. He has since then dispensed with the jejunal clamp. He also believes that pyloric exclusion is one of the determining factors. In cases in which there is a great increase in acidity, it would be well to investigate the gastric contents from time to time.

The question of the influence of the removal of a diseased appendix upon its incidence has not yet been worked out.

True jejunal ulceration occurs in less than 2 per cent of the cases.

Symptoms usually arise within the first two years. In 31 patients with secondary ulceration who have been operated upon by the writer, in 30, symptoms began within eighteen months.

Gastric Symptoms associated with Disease elsewhere in the Abdomen.—There are three groups of cases in which symptoms mimicking gastric or duodenal ulcer may be present ; they are due to, or associated with, disease in the ileocæcal region, gall-bladder, and urinary organs.

In the first named the symptoms may be due to disease of the appendix, or to such conditions as interfere with the function of the cæcum, terminal ileum, or ileocæcal valve. It may be difficult before operation to say to which condition the symptoms are due, for they all bear a resemblance to each other. It is usually possible, however, to suggest an appendicular origin, for, as I have pointed out,²⁸ pain in the right iliac fossa is an accompaniment, not of chronic appendicitis, but of interference with the function of the cæcum.

The writer would urge that the diagnosis of appendix dyspepsia should not be acted upon to the extent of removal of the appendix without complete abdominal exploration.

Our powers of abdominal diagnosis are not yet sufficiently exact to warrant a positive statement that disease is not present in the stomach or gall-bladder. Patients are frequently seen who have had their appendices removed through small incisions in the right iliac fossa, for the cure of symptoms which have proved, on efficient exploration, to be due to duodenal ulcer, gastric ulcer, gall-bladder disease, and, in a few cases, carcinoma of the stomach. It will be noticed that, in all the cases quoted below, the whole abdomen was explored.

Examples of true appendicular dyspepsia do well after operation. In 1914 the writer published the results of operation in a series of cases in a paper on the "Relations of Appendicitis to 'Dyspepsia' and Diseases of Stomach and Duodenum".²⁹ Up to that date I had operated on 81 patients, 46 of whom were men. These were cases operated upon for 'indigestion' in whom, after exploration of the upper abdomen, the appendix was removed. In 65 the appendix was of the thin, obliterative, and adherent type; it is interesting to note that this was the type found in 84 out of 106 removed during operation for chronic gastric and duodenal ulcer during this period. I was able to investigate the condition of 52 more than twelve months after operation: 36 were absolutely well, 6 were nearly well, and 2 'better'; 8 were no better, although their symptoms were identical with those cured by the operation.

Further experience has confirmed these results—that about 75 per cent of the cases of this type are cured by removal of the appendix. That some fail to receive any relief is suggestive of the presence in these cases of early gastric lesions undiscoverable in the course of the exploration. The paper by Lansdown and Williamson,³⁰ giving a preliminary report of their pathological investigations, points strongly in this direction.

The cases in which, in addition to indigestion, there is a more or less constant pain in the right iliac fossa, are not usually cured by an operation consisting of removal of the appendix alone.

Many are relieved by aperients, abdominal exercises, and the use of a well-fitting belt; others in addition need the freeing of adhesions, fixation of cæcum and ascending colon, sometimes ileocolostomy with removal of the ascending colon.

The now well-known gastric symptoms associated with gall-stones are *entirely* relieved by operation.

Renal calculus may be the cause of symptoms mimicking gastric, or more often duodenal, ulcer. These *entirely* disappear after operation.

In a few cases, urinary obstruction, the result of enlargement of the prostate, is associated with gastric symptoms. Operation results in cure.

Gastrojejunostomy has no beneficial effect on any of the above conditions. It is an operation that should be carried out only in the presence of definite organic gastric disease.

Gastroptosis.—The fact that the stomach is lower than normal does not constitute disease. The symptoms associated with this condition are practically confined to the female sex. It must be remembered it is not the stomach only that is prolapsed, nor is it from this organ that symptoms arise in the majority of cases. The patients are of the thin, long-thorax type, and the beginning of the illness is usually constipation. This later becomes associated with irregular gastric symptoms, flatulence, pain at various intervals after food, and occasional vomiting. Neurasthenic symptoms often supervene. In the early days of gastric surgery many of these cases were treated by gastrojejunostomy. Of three treated by myself, all developed bilious vomiting necessitating further operation.

Rovsing³¹ has put it well: "Gastrojejunostomy . . . is a highly injurious operation, inasmuch as not only do the existing symptoms deteriorate greatly, but an entirely new complex of symptoms also supervene, nausea and gall-vomitings". In eight patients he had to operate again, separate the anastomosis, and restore the parts to their previous condition.

In the cases comprised under this heading the symptoms are by no means always due to the one cause. In a few, gastric symptoms may predominate, and a stenosis of the pylorus by kinking, or a chronic obstruction of the duodenum by the mesenteric vessels, be discovered. In others the symptoms are secondary to change in the ileocæcal region.

Thorough investigation by all modern methods should be carried out, including *x*-ray examination after bismuth meals, in order to discover if there is obstruction in any part of the canal.

In no patient should operative treatment be resorted to until all other measures have failed. Rest in bed, diet, and massage, followed by the wearing of an abdominal belt and strict attention to the bowels, will ameliorate many.

Operation on the stomach is contra-indicated except in those rare cases in which pyloric stenosis is produced by kinking. In 3 of these upon whom I performed Finney's gastroduodenostomy, complete cure resulted. In 2 patients in whom there was marked obstruction of the duodenum at the point at which the superior mesenteric vessels crossed it, duodenojejunostomy was followed by cure. This may be the type of case in which it has been recorded that gastrojejunostomy gives relief.

Rovsing³² is an advocate of gastropexy, combined, if necessary, with colopexy in the majority of cases. His results in 163 cases are as follows: Cure, 50·6 per cent; great improvement, 14·7 per cent; improvement, 11 per cent. These results are excellent. All the cases of gastropexy, however, that have come under my personal observation were no better as the result of gastropexy.

Infantile Pyloric Stenosis (Congenital Hypertrophic Stenosis of the Pylorus).—The prognosis of this grave disease has been materially improved by the recognition of the need for surgical treatment in the majority of these cases and introduction of simpler methods of operating.

The death-rate in this country has been high—at the East London Hospital for Children, Warren states that in 30 cases treated medically all died except one, and in this patient the diagnosis was doubtful. At Great Ormond Street, in 1915–17 inclusive, in 54 the mortality was 80·5 per cent; and of 34 operated on, all died.

So far, the most favourable results have been obtained in the United States with Rammstedt's operation and its modifications.

Strauss: less than 3 per cent in 107 cases.

Downes: 175 cases with a death-rate of 17·1 per cent; but in those coming to operation within four weeks of the onset of symptoms, the death-rate was less than 8 per cent.

Although no surgeon in this country has had such an exceptional operative experience of this disease, Tyrell Gray states that the death-rate for cases operated on within four weeks of the onset of symptoms is about 9 per cent. It is evident that the prognosis depends upon the time which elapses before operation is carried out no less than on the particular operation chosen. Great care in post-operative treatment is also necessary. The writer believes that the death-rate will remain high until early diagnosis is the rule and operation is carried out in every case in which that diagnosis is certain. (*See also* p. 469.)

Carcinoma of the Stomach.—Unless treated by operation, life is rarely prolonged more than twelve months from the appearance of symptoms. The results, both immediate and remote, of the treatment by partial gastrectomy, are yearly improving, and the operative risk at the present time in the hands of surgeons experienced in this branch of surgery should not exceed 10 per cent.

The longest and most successful series of cases are those published by C. H. Mayo.³³ Resection was carried out in 736 cases with a mortality of 13·7 per cent. The immediate mortality in the later series has been 7 per cent; 37·6 per cent of the patients were alive and well three years later; 25 per cent more than five years.

Sherren: 65 partial gastrectomies, 6 deaths from operation; 19 are without recurrence over three years since operation; two are now over ten years, and three over six, and one died of another cause after remaining well and free from recurrence for seven years. Death occurred from recurrence, the earliest three months, the latest thirty months, after operation.

The percentage of cases suitable for radical operation must vary in every clinic, depending as it does upon the education of the physician to modern surgical doctrines in the area drained by the hospital. It should get higher as time passes. It is roughly, at the present time, from one-third to one-fifth.

Mayo Clinic, 736 out of 2094.

Sherren, 65 out of 266.

W. J. Mayo sums up the present outlook as follows: "A patient with a cancer of the stomach which is sufficiently localized to be removed radically has better than a 90 per cent chance to recover from the operation, better than a 36 per cent chance of a three-year cure, and at least a 25 per cent chance of a five-year cure".

When recurrence takes place, the average duration of life is eighteen months, but the quality of that life is much better than if gastrojejunostomy alone had been done. Comfort is usually given until shortly before death, which does not generally occur from recurrence of growth in the portion of stomach which remains. Recurrence is rare after two years, and if life extends beyond four years is very unusual.

Even the collected cases of Paterson, in 1906, gave a percentage of 15 per cent out of 79 alive and well more than five years after operation, and 38 per cent well three years after.

It is obvious that the outlook in carcinoma of the stomach, if operated upon early, is extremely good. But it is necessary to refer suspicious cases to the surgeon at once. The death-rate of simple exploration is small. As a rule, death occurs within three months, and occasionally a period of improvement occurs and all symptoms disappear. Eight such cases have been under my care. In one the symptoms remained in abeyance for eighteen months, in another for fourteen.

Total Gastrectomy.—It is rarely that this operation is indicated in cases of carcinoma of the stomach of the usual type. It is necessary in rare instances in which the disease arises in the fundus, or in the small group of cases of plastic linitis—leather-bottle stomach of the malignant type. The immediate death-rate is higher than that of partial gastrectomy.

Mayo, in 7 cases in which an almost complete operation was carried out, had 3 operative deaths, and no patient survived two years.

Carcinoma of Cardiac End.—At the present time, radical treatment of malignant disease in this situation is not established upon a successful technique. Several cases, however, have been recorded in which the growth was removed and oesophago-gastrostomy done. Death occurred in all within a few days. Zaaier³⁴ has recently recorded a successful case in which, after the performance of gastrostomy, the growth was removed in two stages.

Palliative Operations in Carcinoma of Stomach.—Gastrojejunostomy is of striking service in the relief of symptoms when the growth is causing pyloric obstruction, and in the rare cases of malignant hour-glass stomach. Its performance should be limited to these, for it affords little or no relief when the growth is not causing mechanical obstruction.

The immediate death-rate is much higher than when the operation is carried out for simple conditions. Thus:—

Poncet, Delore and Leriche: 87 cases, 33 per cent.

Moynihan (up to 1906), 35 cases: 14 per cent.

Sherren (up to 1921), 72 cases: 12 per cent.

The average duration of life is about six months. The longest in my series was two years, with twenty-two months' absolute comfort; another fifteen months; 2 over a year. The relief afforded is striking, and the operation certainly one to be recommended. The patients are usually able to resume ordinary life.

Gastrostomy and Jejunostomy.—These operations do not stand on the same plane with gastrojejunostomy. As a routine procedure in inoperable carcinoma of the stomach they are inadvisable. It is one of the operations that must be left to the choice of the patient, remembering that the quality of life is not good, and that the discomfort of artificial feeding is very great to some individuals.

The immediate death-rate of gastrostomy is low. As a rule, life is not prolonged more than six months, usually less.

Jejunostomy in 127 cases collected by Billon³⁵ gave a death-rate of 29 per cent, and the majority lived less than two months.

Sarcoma of Stomach.—There are clinically two types of this disease: one in which the tumour is often round-celled and the symptoms resemble those of carcinoma; the other in which a polypoid tumour is present, springing usually from the greater

curvature. The average duration of life is about fifteen months in the round-celled, twenty-eight months in the polypoid.

Gosset³⁶ has recently collected 61 cases of sarcoma of stomach treated by operation. Of these, 29 were of the polypoid type, 10 deaths. The longest survival was seven and a half years. Of the first type there were 22; 13 were resected, with 5 deaths, 3 patients living one, four, and six years after operation.

The writer has treated by resection 2 cases of the polypoid type. In 1 already recorded,³⁷ recurrence took place within three months. The other, a boy of fourteen, remains well seven years later.

Plastic Linitis (*Cirrhosis of stomach: fibromatosis of stomach: Alexis Thomson*).—This disease is characterized by a diffuse fibrous thickening of the stomach involving the submucous coat and starting usually in the pyloric region. The condition may be either simple or malignant. The relative frequency of the two types is difficult to estimate, for it may be impossible, even after microscopical examination of the stomach, to say to which group it belongs. Sections of the stomach may appear simple, yet secondary deposits may be present in the liver. Unrelieved by surgery the disease is uniformly fatal.

Lyle,³⁸ in an exhaustive paper bringing the subject up to date, found in 43 cases the average duration of life was forty-nine months (shortest three months, longest twenty years). In 37 of the so-called malignant type, the average was 23.9 months.

He records 25 cases treated by operation: 3 total gastrectomy, 1 well four years later; 13 partial gastrectomies—details of many of these are lacking, but life was prolonged beyond two years in at least 3 cases; 8 gastro-enterostomy—of these there were 4 operative deaths, 1 died four years after operation, cause not known; others were alive and well eight years, four, and three and a half years after operation. There is, in addition, Moynihan's case of complete gastrectomy³⁹ for the malignant type of the disease in which death occurred four years later.

Jejunostomy: 4 cases: 3 died within a few days, 1 is alive and well five years later.

Eleven cases have been operated on by the author. To the naked eye, all were typical of this condition. Five were certainly malignant, although in 1 with secondary deposits in the liver, sections of the stomach wall revealed no trace of malignancy. Of these cases, 5 were treated by gastrojejunostomy: 1 is alive and well nine years later; 1 died four years later from carcinoma of liver; 1 lived in comfort for a year and died in twenty months; 1 died five months later; 1 died the day following operation.

In 1 patient in whom I performed jejunostomy, life was prolonged in reasonable comfort for four months. Gastrectomy, complete or partial—failing this, gastrojejunostomy—allows of prolongation of comfortable life with a prospect of cure.

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James Sherren.

STOMATITIS. (See also CANCRUM ORIS and SCURVY.)—Most of the conditions included under this title are, of course, transient and of no great importance.

Simple Catarrhal Stomatitis, Thrush, the Aphthous variety, and the Chronic form sometimes met with in adults, very seldom do any harm, and yield in a week or two to treatment, such as removal of the cause and the use of mouth-washes. In weakly infants, however, infection with the *Oidium albicans* is sometimes a serious matter, and may turn the scale against the child by leading to semi-starvation and septic absorption.

Multiple simple ulcers of the mouth in adults sometimes show a tendency to relapse every spring, and may last for weeks at a time.

Mercurial Stomatitis seldom lasts long, or does any harm, if it is recognized and the drug withdrawn; but if this is long delayed, the patient's mouth may get into a dreadful state, and in rare cases in the past there has been a fatal issue, so that at one time it was a capital offence in France to prescribe mercury as a medicine.

Ulcerative Stomatitis is also a grave disease in weakly children. Usually it yields to treatment with potassium chlorate and other similar remedies, but when the mouth is very foul, with gangrenous areas and white or grey sloughy ulcers, there is considerable danger to life. The writer has seen a case in a boy of twelve, beginning as an ulcerous condition of the gums, and steadily advancing all over the alveolar borders, but, unlike cancrum oris, sparing the cheeks. Mercurialism and scurvy were excluded, and there had been no previous illness. In spite of cauterization and other energetic treatment the boy got worse, and an attempt was made to burn away the foul areas; but he was *in extremis* and died under the anæsthetic. A. Rendle Short.

STRICTURE OF ŒSOPHAGUS.—(See ŒSOPHAGUS, STRICTURE OF.)

STRICTURE OF URETHRA.—(See URETHRAL STRICTURE.)

STROKES.—The term stroke, or *ictus*, is applied to a spontaneous cerebral attack due to some form of vascular disease, whether obstruction or rupture of a cerebral vessel. In a severe case, the patient at once becomes comatose and hemiplegic; in other cases, hemiplegia occurs without loss of consciousness.

Prognosis as to Life.—The prognosis of recent hemiplegia depends upon the *nature, extent, and situation* of the cerebral lesion.

The Nature of the Lesion.—With regard to this, we have to determine whether the case is one of arterial obstruction from embolism or from thrombosis, or is one of hæmorrhage from a ruptured vessel. The rapidity of onset of the symptoms is of diagnostic significance.

Embolism, as a rule, occurs suddenly, the arterial obstruction being due to a plug of fibrin carried in the blood-stream from the left side of the heart, or from the roughened wall of an aortic aneurysm. Consciousness may or may not be lost in cerebral embolism; in most cases it is lost, and the cases where it is not affected are generally those in which the obstructed artery is a small one, and where the paralysis is of correspondingly less extent.

Cerebral thrombosis from disease of the vessel wall, syphilitic or otherwise, or from morbid coagulability of the blood (e.g., during pregnancy or the puerperium), is usually rapid in onset, though less so than in embolism. In syphilitic cases it is often preceded for days by headache or mental confusion, or there may be pre-hemiplegic convulsions, sometimes unilateral. Unconsciousness deepening into coma may be present, as in embolism, if the thrombotic lesion be a large one.

Cerebral hæmorrhage from rupture of a diseased artery or a miliary aneurysm is usually associated with conditions of high blood-pressure, whether from general arteriosclerosis, as in the gouty diathesis or in old age, or from chronic renal disease. In arteriosclerotic cases the actual attack is often precipitated by excitement, emotion, or physical exertion, and a particularly common time of onset is during straining at stool. Other cases occur in morbid blood conditions without vascular disease, as in the bleeding diseases (hæmophilia, purpura, leukæmia, scorbutus, pernicious anæmia); also in certain cases of whooping-cough, where the hæmorrhage is usually due to rupture of a cortical vein during a paroxysm of coughing.

Other things being equal—i.e., in lesions of equal size and similar situation—the prognosis as to life is more serious in hæmorrhage than in thrombosis, since it is easier to stimulate the circulation in cases of thrombosis than to depress it in cases of hæmorrhage. Embolic cases, as a rule, have a good prognosis, except when due to ulcerative endocarditis, in which the infective nature of the embolus renders the prospects hopeless.

The Extent and Situation of the Lesion.—The size of the lesion is an important element in prognosis. The larger the area of brain tissue that is destroyed, the graver the prognosis. This statement, however, must be qualified by the further consideration of

the situation of the lesion : since it is obvious that a relatively small lesion in the medulla or pons may be rapidly fatal, whereas in the corona radiata it may produce comparatively slight symptoms.

Coma.—The occurrence of coma, and its duration, have an important prognostic value. Coma is one of the signs of increased intracranial pressure, and the larger the hæmorrhage, as a rule, the deeper the coma. (There is an important exception to this rule in the case of hæmorrhages in the region of the medullary vital centres, where a small lesion may prove rapidly fatal.) If the coma be slight in degree, or if it be short in duration, even if deep, we give a favourable prognosis as regards life. Where it is profound and early in onset, a very guarded prognosis should be given; and where it persists for over twelve hours without any diminution in intensity, the prospects of survival are small. In cases which are likely to recover, signs of consciousness usually begin to return in two or three hours. Cases which remain deeply comatose for twenty-four hours rarely survive. If a patient with initial hemiplegia and coma returns rapidly to consciousness, and then suddenly relapses into coma, this suggests the presence of a hæmorrhage into the ventricles, and the outlook is practically hopeless.

Temperature.—A study of the patient's temperature is also of importance. A normal temperature is a good sign. In cerebral hæmorrhage there is often an initial fall, followed by a moderate pyrexia. The more severe the lesion, the more profound are the temperature reactions. In a bad case, the temperature may fall to 96° or even 94.4° , and the patient may die before the occurrence of any pyrexial reaction; generally the initial fall is followed by a rise. The higher the temperature, the graver the prognosis; and if hyperpyrexia of 105° to 108° occurs, the outlook is hopeless.

The Cardiovascular signs should also be carefully observed. If the pulse becomes abnormally slow or quick, or if its rhythm becomes irregular, the prognosis is unfavourable. A progressive rise of blood-pressure is another unfavourable sign, indicating venous obstruction in the bulbar circulation, necessitating special activity of the vasomotor centre in order to force an adequate blood-supply through the compressed vessels of the bulb.

Deepening Stertor of breathing, and the occurrence of a *Cheyne-Stokes type of respiration*, are also signs of deepening bulbar embarrassment.

Albuminuria or *Glycosuria*, if present, increases the likelihood of a fatal issue, since these conditions indicate the activity of other factors in addition to the mechanical one of the vascular intracranial lesion.

Convulsions, occurring in a comatose and hemiplegic patient, are always of grave import; they may indicate irritation of the cerebral cortex from a meningeal hæmorrhage producing clonic fits, or they may be due to uncontrolled activity of the mid-brain centres, producing tonic rigidity of the limbs, as when a hæmorrhage bursts into the ventricles or into the substance of the pons.

Prognosis as to Recovery.—The foregoing signs concern themselves mainly with the immediate prognosis as to life. Should, however, the patient survive the particular attack, the further question arises as to how far his hemiplegic symptoms are likely to clear up. The answer to this question depends upon the size and situation of the lesion. A small lesion which does not interrupt the pyramidal fibres, but merely compresses them, may produce signs and symptoms which ultimately clear up completely. In other cases, where a certain proportion of pyramidal fibres are destroyed, whilst others are merely temporarily compressed, as in a small cortical or subcortical lesion, the original hemiplegia may recede to a monoplegia as the clot shrinks by absorption and the unsevered fibres recover their function. It is difficult to lay down definite rules for guidance on this point, but it is generally recognized that if any material improvement in the hemiplegic symptoms is likely to occur, some signs of return of power will be found within a week or ten days. Improvement, as a rule, begins in the lower limb before the upper. Trousseau stated that when the arm begins to recover before the leg, the ultimate result is less satisfactory; but this dictum is not absolute.

The occurrence of early rigidity of the hemiplegic limbs—i.e., within the first week—is unfavourable as regards recovery of motor power. Rigidity of later onset, with increased deep reflexes, indicates permanent degeneration of the pyramidal fibres.

The appearance of an acute sloughing bed-sore on the hemiplegic side, whether over

the sacrum, great trochanter, outer malleolus, or heel, in a patient who is being assiduously nursed, and whose skin is being watched and protected (as that of all paralyzed patients should be), is of grave import—the *decubitus ominosus* of Charcot. Sometimes it occurs within a few days after the onset of paralysis, and is resistant to treatment; it occurs chiefly in cases of profound hemiplegia in which there is a degree of mental obtusion.

J. Purves Stewart.

SUBPHRENIC ABSCESS.—Under this heading we include abscesses beneath the diaphragm of varying origin, the majority following perforation of a gastric or duodenal ulcer, or of the vermiform appendix. Tropical abscess of the liver, spinal caries, and a number of other primary causes lead to subphrenic abscess, but much less commonly than those first mentioned. We are greatly indebted to the late Mr. Harold Barnard for his classical study of the subject, based upon the records of 76 cases at the London Hospital.

As a complication of appendicitis this disease is not uncommon, and, unless early recognized and energetically treated, it is almost a death warrant. The usual course of events is that the patient is operated on about the third or fourth day or later, and a fairly widely-diffused peritonitis is found; the appendix is removed and a drainage-tube put in, but the temperature remains high, or falls for a few days and then rises again, and the patient wastes, and may vomit or have rigors. Careful examination may reveal a resistant or tender area in the right upper abdomen, or there may be dullness and absent breath-sounds at the base of the right lung. A skiagram shows very prettily the fixed, high-arched, raised dome of the diaphragm on the affected side.

Having defined what class of cases enters into the argument, we may now inquire into the prognosis.

Barnard reported on 76 cases. Of these :—

	12 cases not operated on :	0 lived,	12 died = 100 per cent
	64 cases operated on :	40 lived,	24 died = 37·5 „
Barnard's own,	21 cases operated on :	17 lived,	4 died = 19·0 „

Of the 36 fatal cases, 24 are classed as avoidable, that is, they either passed undiagnosed, or the operation did not secure proper drainage, as for instance when an anterior drain was used in cases demanding a posterior. Posterior drainage is secured by removing part of a lower rib, and traversing the pleural cavity as well as the diaphragm.

In 23 out of 76 cases, the abscess ruptured spontaneously (into bronchus or pleura 9 times, into stomach 8 times).

The operation mortality given by various German authors agrees closely with the figures just quoted.

In estimating the prognosis in any particular instance, it must be borne in mind that when the stomach is the primary locus of the disease the outlook is graver than in appendicitis cases (Keen). Rigors are an unfavourable sign, 6 out of 10 dying (Barnard), and so is jaundice, because these may indicate portal pylephlebitis. Early operation gives much better results, of course, than late; according to Sachs :—

Operation within 3 weeks :	15 per cent died
Operation after 3 weeks :	50 „ „

Posterior drainage gives better results than anterior, as is shown by Barnard's table.

26 poste rior operations :	7 died = 27·0 per cent
43 anterior operations :	17 died = 39·5 „
4 lateral operations :	3 died = 75·0 „

Personally, I have been very satisfied with a posterolateral drain beneath the diaphragm and lower ribs; this avoids the necessity of having to go through the pleura.

We may conclude, therefore, that in practice about one-third of the cases die, but that careful diagnosis and prompt efficient drainage would probably save four out of five.

REFERENCE.—*Brit. Med. Jour.* 1908, i, 371, 429.

A. Rendle Short.

SYNOVITIS.—(See KNEE-JOINT, INJURIES OF; SYPHILITIC JOINTS.)

SYPHILIS.—A diagnosis of syphilis at once prompts a number of questions, which can be classified under the following headings :—

I. The prospects of the disease being eradicated by treatment, and the length of the treatment.

II. Assuming treatment to have failed to eradicate the disease, the prospects as to future disability from recurrences.

III. The risks of treatment.

IV. The chances of transmitting the disease to others, (1) By social intercourse ; (2) By sexual intercourse ; (3) To children.

I.—THE PROSPECTS OF SYPHILIS BEING ERADICATED BY TREATMENT.

Before the first of these questions can be answered, it is necessary to lay down a standard by which to judge whether or not the disease has been eradicated. Before the Wassermann test and examination of the cerebrospinal fluid were tests of syphilis, absence of clinical signs for a number of years was held to indicate that the patient was cured. We know now that, after infection, a person may show no clinical signs for forty years or more and yet the blood reaction be strongly positive. Can we say that, notwithstanding these changes in the blood or cerebrospinal fluid, or both, such a patient is cured ? On this question opinions differ. Some hold that such serological changes do not necessarily indicate present activity of *S. pallida*, but may be due to a permanent effect, on the tissues, of spirochætes long since dead. In support of their view they cite numbers of instances of hale and hearty old men with strongly positive reactions, which no amount of treatment appears to affect. Others hold, on the other hand, that we must regard a positive reaction as indicative of still-present disease, whatever the effect on it of anti-syphilitic treatment. Though it would occupy too much space to discuss this question fully, its importance compels some remarks, because our interpretation of a positive Wassermann reaction and of changes in the cerebrospinal fluid must determine our judgement as to what constitutes eradication of syphilis. In a given case can we say, on clinical evidence only, that the disease has been eradicated ? The answer to this is that every syphilologist can cite numbers of instances to prove that a negative clinical examination does not exclude syphilis. For example, a hale and hearty old man with a history of syphilis contracted in his youth, but with no blemish on skin or mucous membranes ; with no history of a recurrence for many years ; with arteries no harder than those of many non-syphilitic men of the same age, may easily be passed on clinical evidence as no longer suffering from syphilis, and yet the next day begin to show signs of a late syphilitic lesion. It is known also that most late syphilitic recurrences occur in persons with a positive Wassermann reaction, or with changes in the cerebrospinal fluid, though it is granted that in some even these signs are absent. The investigations of Stokes^{50, 51} in the Mayo clinic show that, if such patients are submitted to expert examination, in only ten per cent are there found no other signs of syphilis. Of particular importance are the evidences of cardiovascular and nerve disease found in a large proportion of these persistently positive cases. These considerations compel the belief that a positive Wassermann reaction of the blood serum, or pathological changes in the cerebrospinal fluid, spell active syphilis.

Granted that we may not count as cured any who show a positive Wassermann reaction or pathological fluid, may we say that persistent absence of these changes indicates eradication of the disease ? I do not think we are yet in a position to do so, because, just as syphilis may remain *clinically* latent for very many years and then reawaken, so is it possible that the virus may remain so quiescent that it does not evoke those changes in blood and cerebrospinal fluid which are detected by laboratory tests. An example of this is the case of *chancre redux*, where, in the site of an old primary sore, the virus reawakes, though the patient's blood serum has been persistently negative. If spirochætes can remain so quiescent in a chancre that they do not provoke blood changes, they may remain so in any other syphilitic infiltrate. Further, there are some patients who, even at the time they are suffering from obviously syphilitic lesions, give a negative Wassermann reaction.

Stronger evidence of cure than a persistently negative Wassermann reaction and absence of changes in the cerebrospinal fluid is perhaps provided by reinfection. Since

the introduction of arsenobenzol treatment a large number of reinfections have been reported by various observers: far more than in the whole of the pre-salvarsan era. It is true that many of these so-called reinfections have been instances of recurrent chancre, but, when these are excluded, the number remaining as to which there can be no doubt is still considerable. It is known that, so long as the syphilitic virus acts upon the tissues, the latter are so resistant to any fresh syphilitic infection from without that a second syphilitic chancre cannot be produced after about the tenth day. Reinfection, therefore, implies that the original virus has ceased to act on the tissues. Many go further, and infer that it means death of the original virus. But this does not seem quite justifiable, since we know that the syphilitic organism may for years remain so quiescent as not to provoke a Wassermann reaction and yet reawaken, and it is reasonable to suppose that it may remain so dormant as not to evoke that strength of immunity which enables the tissues to resist reinfection. Altogether, therefore, great as is the temptation to regard reinfection as proof of cure, it seems more reasonable to consider it as indicating only complete quiescence of the syphilitic organism. That reinfection has become much more frequent since salvarsan was introduced must, however, be reckoned as evidence that, in the arsenobenzol compounds, we have remedies which go far nearer to the eradication of syphilis, and that with a comparatively few months' treatment, than was ever possible with mercury alone.

To sum up on the general question whether or not it is possible to eradicate syphilis, although we are not yet in a position to say with certainty that syphilis can be eradicated, we can say that there are now a number of cases in which no signs, either clinical or serological, have reappeared, though no treatment has been given for seven years or more, and that many others have become reinfected. That is strong evidence that these patients have been cured, though it is not certain evidence. The present practice is to regard as cured a patient who, for two years after suspension of all treatment, and in spite of attempts to stir any latent spirochaetes to fresh activity by periodical injections of small doses of arsenobenzol, has shown no signs either clinical, serological, or in the cerebrospinal fluid. So far this criterion of cure has been supported by the subsequent history of patients who have satisfied it, but their numbers are few and their subsequent history short, when the length of time during which syphilis may remain latent is considered, and further experience may compel us to revise the standard. The cases in which, with the above reservations, the disease can be said to have been eradicated, have been in the early stages, and the treatment by both arsenobenzol and mercury has been prolonged for many weeks or months beyond the time when serum and cerebrospinal fluid were rendered normal.

In cases of hereditary syphilis there is strong evidence that arsenobenzol and mercurial treatment of the foetus through the mother results in its cure. A number of workers have now published results showing a high proportion of apparently healthy infants whose Wassermann reaction has remained negative for some years as a result of this treatment. We are not yet, however, in a position to say that the disease has been completely eradicated in these cases, and it is to be recommended that treatment of the infant be continued for about two years after its birth. As would be expected, the most successful results have been obtained where treatment has commenced very early in the pregnancy, but many apparently healthy infants have been born of mothers in the secondary stage, though treatment of the foetus in utero began comparatively late in the pregnancy.

As to the prospects of effecting a cure in the older cases, the evidence is unanimous as to the increasing difficulty of eradicating the disease the longer the virus remains in the tissues unattacked; and, generally speaking, if a patient is found to have a positive Wassermann reaction or changes in the cerebrospinal fluid a year or more after infection, there is little hope of eradicating the disease with the remedies at present at our disposal. In such cases the saying, "Syphilis never dies, it only sleeps", must be regarded as probably true. This does not mean that the disease will certainly recur in a form which can be recognized as syphilitic with the naked eye. It means that the blood or cerebrospinal fluid, or both, will show evidence of active syphilis. The chances of clinical recurrence will be discussed below.

II.—THE PROSPECTS AS TO FUTURE DISABILITY FROM RECURRENCE.

Assuming the disease not to have been eradicated, the question arises as to the possibility of recurrences, their form and effect on the general health, and their tractability. The patient is interested chiefly to know if and when the disease may recur, the form it may then take, and its probable effect on his general health. He is not perhaps greatly interested in statistics as to the relative frequency of each form of recurrence; it is sufficient for him to know what may occur, since, even if such and such a recurrence is rare, he has no reason to suppose that he will be amongst the lucky majority who escape. The avoidance of recurrences and their tractability are also, of course, questions which interest the patient deeply. The practitioner also may be interested in the possibilities in order to assess the patient's health for life assurance purposes. He wishes to know by how much, if any, the patient's life will be shortened by his disease. He can determine the question only by a study of statistics relating to the fate of numbers of syphilitics in the past.

After the primary stage, syphilis may recur in various forms, which may conveniently be classified under the following general headings:—

1. Acute yellow atrophy of the liver.
2. Generalized eruptions of the skin and lesions of the mucous membrane, all of the secondary type.
3. Gummata, with possible ulceration, of the skin, mucous membranes, subcutaneous tissues, bones, joints, and testes.
4. Syphilitic arteritis, leading to aneurysm, thrombosis, or general arteriosclerosis, with the effects of these on the nutrition of the tissues supplied by the arteries affected (e.g., brain, heart, etc.).
5. Gummatous infiltration, which may be diffuse or localized, of the viscera, with possibly resulting amyloid diseases of spleen, liver, and kidneys.
6. Gummatous infiltration, either diffuse or localized, of the supporting structures of the brain and spinal cord.
7. Tabes dorsalis. General paresis.

It is credited also by many workers with reducing the resistance to certain intercurrent affections, of which the commonest are tuberculosis and cancer.

Acute Yellow Atrophy of the Liver.—This was a very rare event in syphilis prior to the introduction of salvarsan, though jaundice was stated to occur in about 0·3 per cent of cases. Liver disturbances have now become more frequent, but the increase is most probably due to arsenobenzol treatment, and will be discussed below under dangers of treatment.

Early Recurrences of the Secondary Type in the skin and mucous membranes are very frequent under a purely mercurial therapy, but are comparatively rare under the modern treatment by arsenobenzol and mercury. This is illustrated by the following. An analysis, by the writer, of the case-sheets of 378 syphilitic soldiers under regular mercurial treatment showed that 315 (83 per cent) relapsed at least once during the first year of the disease. Of these, 115 relapsed twice, and 49 three or more times. In contrast with this, of 89 cases treated with salvarsan and mercury and watched for eighteen months after suspension of all treatment, 82 remained free from clinical signs. The serological relapses in this series were 28·1 per cent,¹ which contrasts with 45·5 per cent serological relapses discovered in 492 soldiers only three months after two years' regular mercurial treatment. Gennerich² found, in 162 primary and secondary cases treated for less than six months with salvarsan and mercury and watched for one to two years after, that 152 had remained free from all signs, clinical, serological, or in the cerebrospinal fluid; 4 had become reinfected; 2 had relapsed clinically; 2 relapsed serologically; and 2 had shown changes in the spinal fluid after provocative injections. The primary cases of this series had been treated with six to eight salvarsan injections, with a follow-up course, three weeks later, of two to three more salvarsan injections, with fifteen injections of calomel. The secondary cases had been treated with seven salvarsan injections in the first course and six in the second, which commenced a month after the end of the first course. This was supplemented by fifteen calomel injections. It should be noted that the cases mentioned in both these series were treated with '606', not '914'. Gennerich and many others, including the author, consider that '914' is far inferior to '606' in permanence of effect. An enormous number of patients were treated during the war in British

Army hospitals on a fairly definite plan, but the conditions prevented exact observation of these cases afterwards, and only general results can be given. In 1918 I thought that, by a scrutiny of case-cards, some idea might be gathered as to whether clinical relapses were as frequent after arsenobenzol and mercurial treatment as after mercurial treatment, since a soldier who developed a recurrence would be re-admitted to a special military hospital, and be recorded as a relapse in the case records. In 35,083 cases were discovered 606 who had previously been treated with arsenobenzol and mercury, the amount of arsenobenzol varying from 0.6 grm. to 2.4 grm. or more. In 18,500 cases analyzed by Major C. F. White, 730 were relapses, of which 634 had certainly been previously treated with arsenobenzol. Major W. de M. Peyton found, amongst 5000 cases, 965 relapses, of which 282 had previously received no treatment, 398 only mercurial, and 285 arsenobenzol treatment of some kind.

Unfortunately none of the figures collected during the war can yet be related to the total number treated on each system; but they show very plainly the profound effect of arsenobenzol compounds during the war in keeping down the number of clinical relapses in the British Army, since it was to be expected, from the pre-war scrutiny of case records of patients under purely mercurial treatment, which has been mentioned above, that, but for the arsenobenzol treatment, at least half of the cases in each of the above series would have been found to be relapses. Put in another way, but for arsenobenzol treatment the accommodation for syphilis would have had to be doubled. Early recurrences in the skin and mucous membranes seem to respond as readily to renewed arsenobenzol treatment as the original lesions.

Tertiary Lesions of the Body Framework and the Testes.—The relative incidence of later recurrences, called tertiary, in the skin and mucous membranes, subcutaneous tissues, bones, muscles, joints, bursæ, and testes cannot be gauged with any accuracy even from pre-salvarsan statistics, which naturally cover a longer range of time. Grön's analysis of 37,757 cases of syphilis, collected from all sources, showed 11.8 per cent late recurrences of all types. This is probably well below the mark, since many investigators have come to the conclusion that over this percentage of syphilitics die of the effects of the disease, and recurrences in the tissues under discussion are not those which kill. Thus, Mattauschek and Pilez's³ analysis of the later history of 4134 officers disclosed that a minimum of 12 per cent die or become seriously ill because of recurrences. This is based on figures relating to general paresis, tabes, cerebrospinal syphilis, aneurysm of the aorta, and only 40 cases of syphilis of the skin, mucous membranes, and bones. Fournier's analysis of 4400 cases of tertiary syphilis showed that 1451 affected the skin; 644 the different mucous membranes (including 262 tongue and 215 soft palate); 519 the bones, exclusive of 229 nasal bones and palate; 202 the subcutaneous tissues; 281 the genital organs, exclusive of 245 testicle; and 41 muscles, joints, and tendons. But statistics gathered from clinical practice are not a very reliable index of the frequency of different types of late syphilitic recurrences relatively to all others, since different forms of tertiary lesion naturally come under the notice of different specialists, and one of these is sure to show an undue preponderance of one type or another. This is illustrated by Fournier's figures, which included, in 4400 cases of tertiary syphilis, 628 tabes, 86 general paresis, 23 affections of the lungs, and 15 arterial disease; from which it might be inferred that tabes was over seven times as frequent as general paresis (instead of about half, which is more nearly correct); and that tertiary lung disease, which is well known to be comparatively rare, was one and a half times as common as arterial disease, which is known to be common. Tertiary lesions of the body framework and testes are, however, fairly easily recognized, and therefore likely to be referred to a syphilologist; so that, although Fournier's figures cannot be regarded as a true index of the proportion which syphilitic recurrences in the body framework and reproductive organs bear to *all* late recurrences, they may be taken as a fairly accurate guide to the frequency of late lesions in one part of the body framework as compared with those in another.

For practical purposes, however, an exact estimate of the probabilities as to recurrence in the tissues under discussion is not of very great importance, since they are not usually dangerous to life.

Generally it can be said that mutilating destruction, e.g., of facial and nasal bones, is now rare, and any recurrence in these parts can be arrested very promptly by arseno-

benzol treatment. Tertiary glossitis with leucoplakia is important, however, since it predisposes to cancer. Though more resistant than most other types of recurrence, it is quite amenable to modern treatment.

There is, of course, no time limit to the manifestation of recurrences in these parts, as in any other. A substantial proportion (according to Fournier, about a third) develop within the first four years, but recurrences after fifteen, twenty, or more years' quiescence are quite common. It is not yet certain whether or not the modern arsenobenzol and mercurial treatment will have the effect of reducing the incidence of late recurrences in these tissues, but it is the strong impression of the writer that they have so far been fairly rare in cases previously treated with these remedies. This impression is confirmed by Weckselmann,⁴ who stated in 1914 that he had not yet seen a tertiary recurrence in the 10,000 cases he had treated with salvarsan since 1910.

Recurrences in the Arteries, Viscera, and Central Nervous System are naturally of much greater moment, since it is from these that syphilis derives its importance as a killing disease and a cause of inefficiency. The case incidence of these recurrences can be determined only approximately, owing to the difficulty of tracing accurately the histories of a large enough series of cases. Syphilis is a long-drawn-out disease, which may remain quiescent for fifty years and then reawake. Also the relationship between syphilis and certain types of disability is often unrecognized. Certain types of recurrence are, of course, easy to recognize, and are probably recorded fairly faithfully; such are general paresis, tabes, and aneurysm of the aorta. But others, such as syphilitic myocarditis, syphilitic coronary arteritis, and some forms of syphilis of the central nervous system, may easily be overlooked. It is often, too, difficult to say what part syphilis has played in a death from cirrhosis of the liver, interstitial nephritis, general arteriosclerosis, or apoplexy. The usual practice is to regard general paresis, tabes, and aneurysm as certainly syphilitic; cardiac failure and apoplexy under the age of 50 as distinctly suspicious; and cirrhosis of the liver, interstitial nephritis, general arteriosclerosis, though more often due to syphilis than is commonly supposed, as having too undetermined a relationship to syphilis to be reliable for purposes of calculation. The difficulties of calculation mentioned above are responsible for differences of opinion as to the relative incidence of each type of syphilitic recurrence. The problem has been attacked in different ways—the experience of syphilologists; of pathologists in post-mortem examinations; of those who have followed out the history of syphilitic subjects for long periods; and of those who have analyzed the causes of death amongst such persons as policy holders. There are also available the reports of the Registrar-general. The records of syphilologists do not seem likely to prove helpful in determining the incidence of what may be termed the killing recurrences, since a large proportion of these remain with general physicians and specialists in other departments.

Post-mortem records affect mostly one grade of society, the hospital class, and are affected, too, by differences of opinion amongst pathologists as to what constitutes a syphilitic lesion or the remains of such. They are useful, however, as a guide to the incidence of visceral syphilis. Thus, as showing the infrequency of syphilis of the lungs in acquired syphilis, in 2000 autopsies at the Johns Hopkins Hospital, lesions believed to be syphilitic were found in the lungs only twelve times.⁵ In 188 cases of pancreatic disease, syphilitic lesions were found three times.⁶ The stomach was found to contain a syphilitic lesion once in 98 autopsies.⁷ In regard to syphilis of the stomach, however, it should be stated that this type of recurrence appears to be more frequent than has commonly been supposed. Thus, Udo Wile⁸ quotes Neugebauer⁹ as having found a marked deviation from the normal findings after test meals in 200 cases of early syphilis. In regard to later manifestations he quotes Ewald,¹⁰ who ascribes 10 per cent of gastric ulcer to syphilis; and Fenwick,¹¹ who found gummata or other evidence of syphilis in the stomachs of 132 fatal cases of ulcer. Wile considers, however, that Ewald's 10 per cent and Neumann's¹² 20 per cent are too high. Perforation is recorded in two cases by Schreib¹³ and by Selenew.¹⁴ Submucous gummata affecting the pylorus and the greater curvature, and diffuse syphilitic infiltration causing hour-glass constriction, have been found by various workers. Morris¹⁵ concludes an article on the subject by saying that many cases are overlooked, and that every case of gastric ulcer which does not yield to dietetic treatment should have a course of antisiphilitic treatment before having recourse to surgery.

Post-mortem examinations have shown that *late recurrences in the liver* are much commoner than would be thought from examination during life. Thus, 19,217 autopsies included in the records of the Johns Hopkins Hospital (2500), St. George's Hospital (11,629), and Flexner's series (5088), disclosed 164 gummata or their scars. In the 55 Johns Hopkins cases, syphilis of the liver was diagnosed only 30 times during life. Mattauschek and Pilez¹⁶ traced out the histories of 4134 officers of the Austrian Army infected before 1900, and found that, by January 1912, cirrhosis of the liver had been discovered twenty times, having accounted for death in 3 cases before the tenth year and 9 from ten to twenty years after infection. McCrae,¹⁷ in an analysis of 27,000 general medical cases, found that syphilis of the liver had been diagnosed in only 0.2 per cent, but was discovered in 1.5 per cent of 3300 autopsies. In the 46 cases were found 23 with cirrhosis; 21 with gumma; 19 with scars; 8 with gumma and cirrhosis; and 4 with amyloid disease. Wile¹⁸ is impressed by the frequency of hepatic syphilis, of which cirrhosis is the commonest form. The prognosis depends on the degree of cirrhosis, since resolution is naturally accompanied by scar contraction and the effect of this on the hepatic circulation and liver functions generally. It is better, therefore, in isolated gummata than in diffuse interstitial hepatitis. Castaigne¹⁹ holds that Hanot's disease is much more commonly due to syphilis than is supposed. Osler²⁰ described two cases of congenital syphilis and one of acquired, in which a typical syphilitic cirrhosis with gummata was associated with the symptoms of Banti's disease; and at the same meeting Dr. Wynter described a similar case.

In regard to *kidney disease*, Speiss's²¹ 220 autopsies on syphilitic patients disclosed 42 amyloid disease, 21 parenchymatous nephritis, 18 sclerosis, 16 interstitial nephritis, 11 atrophy, 7 sclerogummatous nephritis. The figures disclose a very high incidence of kidney involvement: much higher than would be discovered even in old cases by clinical examination. Osler and McCrae state that syphilitic nephritis has been estimated to occur in 3.8 per cent of secondary syphilitics. My own experience of several thousands of early cases leads me to believe that this percentage is far too high, and, judging by urine examinations which are routine in my practice, the incidence is only a small fraction of one per cent. I have never seen a case of fulminating syphilitic nephritis ending in death, such as is described occasionally in the literature. The later manifestations of syphilis in the kidney imitate so closely conditions due to other causes that the relationship is generally impossible to determine. In Mattauschek and Pilez's series¹⁶ occur 4 deaths from acute nephritis and 1 from chronic nephritis in the first decade; 6 from chronic nephritis in the second decade; 1 from acute and 4 from chronic in the third decade; and 1 from chronic nephritis in the fourth decade. These figures do not include 7 who died of general arteriosclerosis, and 15 survivors in whom this affection was the outstanding feature.

Later Syphilitic Affections of the Heart and Arteries, and of the Central Nervous System (*see also* CARDIAC SYPHILIS).—A few general remarks are necessary before considering the incidence of these affections. They are in some respects difficult to separate from one another, since undoubtedly many cases of death from heart failure are the result of coronary arteritis, and many cerebrospinal affections are due to endarteritis of cerebral and spinal vessels. This will be recognized at once in the case of apoplexy, but may not be so apparent in meningitis, though it is probable that obliterating arteritis, resulting in anæmia of the centres supplied, accounts for many of the symptoms. Thus, dullness of intellect and tendency to faint on rising quickly in cerebral meningitis, and paralysis of third-nerve nuclei, are usually due to vascular lesions. Generally, with regard to syphilitic affections of the cardiovascular system, it may be said that they cause a very high proportion of the sudden deaths which occur under the age of forty or even under fifty. Many authors have expressed the strong belief that they are at least as frequent in incidence as recurrences in the nervous system. Undoubtedly many cases of vascular syphilis are not recognized, and those which come to notice and investigation through sudden death are only a tithe of the whole number.

The virus of syphilis has a predilection for the coats of arteries, which is seen in the lesions of the earlier stages in the infiltration of the perivascular lymph-spaces and in an obliterating endarteritis which is secondary to changes in the middle and outer coats. In later stages, because of these changes, with the stiffening and loss of elasticity of the coat, aneurysm is likely to follow in vessels in which the pressure is great. The association

between aneurysm and syphilis was recognized to be a close one in pre-Wassermann days, and the percentage of aneurysm cases which give a positive Wassermann reaction is so very high that most workers now consider that aneurysm of a large vessel spells syphilis. Syphilitic aneurysm of cerebral vessels does not appear to be such a common cause of death in apoplexy as closure of vessels, e.g., the basilar, supplying vital centres. Apart from these, syphilitic arteritis is by far the commonest cause of apoplexy under the age of forty. The usual result is a mono-, di- or hemiplegia, which is relatively seldom fatal.

Besides the syphilitic arterial affections which give rise to symptoms of the tragic type, a more insidious form of arterial disease, resulting in general arteriosclerosis, must be recognized. The connection between syphilis and general arteriosclerosis is often overlooked, since it is by no means the only cause; but my strong impression is that old syphilitics who have not been well treated are old for their years, and I have often been struck by the great improvement in general health and vigour which follows the institution of antisyphilitic treatment in cases where the only obviously syphilitic lesion was quite trivial.

Regarding cardiac affections, endocarditis is rare, and then usually affects one cusp of an aortic valve, which is perhaps more frequently involved in syphilitic meso-aortitis. The most common syphilitic cardiac affection is diffuse myocarditis, associated with, or dependent on, coronary arteritis. Localized gummata of the heart occur much less frequently. Sudden death occurs from rupture through a broken-down gumma, rupture of cardiac aneurysm, closure of coronary arteries, or aortic disease. Gradual death occurs, of course, from failure of cardiac power consequent on muscular degeneration. Of syphilitic affections of the central nervous system, besides those dependent on arterial disease which have been mentioned, the most important are general paresis; tabes dorsalis; and gummatous meningitis, either diffuse or localized, giving rise to hemiplegia, paraplegia, paralysis of various cranial nerves, epilepsy, and insanity.

Some idea of the incidence of syphilitic affections of the nervous and cardiovascular systems may be gained from a study of *Tables I, II, and III*. *Table I* gives the results of the analysis, already referred to, by Mattauschek and Pilez,²² of the later history of 4134 officers of the Austrian Army. The investigation possesses particular value from the fact that all but 813 of the cases were followed up for at least ten years. Its value is discounted somewhat by the fact that the figures relate to one sex, of a particular class (officers), and more or less of one race, so that they are not strictly applicable, as indeed are no single investigator's figures, to all classes of all countries.

Table I.—SHOWING THE RELATIVE FREQUENCY OF THE LATER DEVELOPMENTS OF SYPHILIS IN 4134 OFFICERS IN THE AUSTRIAN ARMY.

History followed for		No. of cases	Developed					
Not less than the under-mentioned years	Not more than the under-mentioned years		General paresis	Tabes	Cerebro-spinal syphilis	Psychoses, including insanity	Died of other diseases	Remained well
1	5	403	9	9	58	7	131	189
5	10	410	47	28	39	26	129	141
10	15	1199	80	29	23	14	124	929
15	20	979	38	21	10	17	83	810
20	25	656	18	16	1	9	41	571
25	30	362	5	7	1	5	23	321
30	35	93	—	3	—	1	7	82
35	45	27	1	—	—	1	7	18
45	65	5	—	—	—	—	1	4
Totals		4134	198	113	132	80	546	3065

The number of deaths amongst the nerve cases is not recorded. The relative incidence of the different forms of cerebrospinal syphilis, apart from G.P.I. and tabes, is shown in an analysis by Mattauschek and Pilez of 253 cases, which included the 132 cases in *Table I*, and resulted as follows:—

	No. of cases
Endarteritis (apoplexy with hemiplegia) - - - - -	109
Meningomyelitis with cerebral symptoms - - - - -	87
Meningomyelitis without cerebral symptoms - - - - -	18
Gummatous basal meningitis - - - - -	16
Paralyses of eye muscles - - - - -	10
Syphilitic dementia - - - - -	5
Syphilitic epilepsy - - - - -	3
Cerebral gumma - - - - -	3
Isolated loss of pupil reflex - - - - -	2
Total	253

Table I, besides being a broad guide to the relative frequency of the different forms of syphilis of the central nervous system, shows generally the dates after infection at which they are most frequent. Thus, nearly half of the cases of cerebrospinal syphilis occurred in the first five years, while G.P.I. was largely concentrated into the 10-15-year period, and tabes, though relatively infrequent before the fifth year, tended more than G.P.I. to extend into later years. The percentage of cases in *Table I* which developed cerebrospinal syphilis (3.19) compares with Hjelmman's²³ 1.5 to 2.5 per cent brain syphilis and Engelsestet's²⁴ 5 per cent. It must be remembered that the above figures are derived from cases which showed clinical signs of disease. Very different figures are obtained when the results of examinations of the cerebrospinal fluid are considered. Thus, Ravaut²⁵ found in secondary syphilis that 68 per cent showed changes in the cerebrospinal fluid. The percentages of cases with fluid changes discovered by other workers have varied greatly, depending on the stage of the disease. Thus Schou,²⁶ in 800 cases of less than three years' standing, found 12 per cent of 131 primary cases; 23 per cent of 300 early secondary cases; 39 per cent of 41 cases of six to twelve months' duration, and 27 per cent of 15 cases of one to two years' duration. Cornaz²⁷ found that 45 per cent of cases with a roseola showed changes in the fluid; 27 per cent of those with condylomata; 35 per cent of those with mucous patches; and 40 per cent old latent and tertiary cases. McIver found in 91 cases, chiefly in the primary and secondary stages, that practically all showed a slight abnormality, if an increase of cells to over 5 per cmm. is counted as such. Plaut²⁸ holds that 84 per cent of untreated cases show changes in the fluid as soon as the Wassermann reaction is positive. Fildes, Parnell, and Maitland²⁹ found that, twelve to twenty-six weeks after infection, 29 per cent of cases examined had pathological fluid. Of the 99 cases with changes in the fluid, only 20 showed symptoms and 8 definite signs of nervous disease. Kyrle³⁰ examined the fluid of 618 syphilitic prostitutes, of whom 228 were suffering from active skin and mucous-membrane lesions, and 390 were clinically latent, apart from the signs of nerve disease mentioned below. The infections of 191 of these dated back five to ten years, and of the balance, ten to thirty years. Of the 228 in the first group (which included 8 primary cases), changes were found in the fluid of 98 (42.9 per cent). Of the 390 latent cases, changes were found in the fluid of 191 (48.8 per cent). In 114 of these 191 cases which were examined by neurologists, 32 showed such slight stigmata of nervous syphilis as inequality of pupils, sluggishness of the pupil, light reflex, disturbances in eye convergence, and differences in tendon reflexes; in 28 the signs were more marked, such as fixed pupils on one or both sides, loss of one or more tendon reflexes on one or both sides, and slight Romberg's sign; and in 7 there were definite signs of tabes or taboparalysis; making a total of 67 with signs which could be detected by careful clinical examination. Doubtless the differences in the percentage of cases with pathological fluid which were found by the workers quoted above are due partly to the standards of their tests, and partly to the different stages at which the fluids were examined. That the latter is an important factor is seen in Königstein and Goldberger's³¹ figures, which showed a gradual rise in the percentage with pathological fluid until the tenth month, and then a decline. Thus, in six-months-old infections there were 44.2 per cent; in eight-months, 51.7 per cent; in ten-months, 57.9 per cent; in twelve-months, 46.5 per cent; and after the first year only 32 per cent. The figures quoted show that, in a substantial percentage of cases, the organism of syphilis invades the central nervous system and evokes changes there, but that in only a small proportion of these are the signs sufficiently marked to be detected by ordinary clinical examination, such as that on which the majority of cases included

in *Tables I* and *II* must be based. It seems as if examination of the cerebrospinal fluid with positive findings had stimulated more careful clinical examinations of recent years, with the result that the proportion of cases discovered to have clinical signs has been raised considerably. It might be argued that nervous syphilis has increased in recent years, but this appears to be met by Ravaut's discovery of lymphocytosis in a high percentage of secondary cases (68) in 1903, and it is likely that the increase is more apparent than real, being due to better methods of examination.

It will be seen from *Table I* that 4.75 per cent of the cases observed by Mattauschek and Pilez for not less than ten years developed general paresis; and 2.39 per cent, tabes. Out of 126 cases which developed tabes, 10 (10.3 per cent) subsequently became paralytics. This compares with Torkel's³² 5.3 per cent and Hirschl's³³ 8.5 per cent. It is of interest to note also that, out of the 132 cases which developed cerebrospinal syphilis, only 2 subsequently became general paralytics and 1 tabetic. The percentage of paresis discovered by Mattauschek and Pilez is considered by some authors to be high, though it is probable that it would have been higher if all the cases could have been observed for a minimum of twenty years. Mattauschek and Pilez thought that the high rate might be explained by the subjects being males, who develop these affections more frequently than females: officers, subject to mental strain; and many of them Magyars, who are believed by some workers to be more prone than other races to develop general paresis, particularly if infected in Hungary. Pick and Bandler³⁴ made a study of the after-history of the cases of syphilis which had been treated in the Prague Clinic from 1879 to 1899. By no means all the cases were traced, and the investigation was closed in 1904, so that many must have been followed for only five years. After excluding worthless reports, the histories of 2067 were available. Out of these, 28 (1.3 per cent) died of G.P.I., all but three commencing after the tenth year. Tabes occurred in 1.1 per cent, more than half commencing between the fourth and tenth years. Of the remainder, 14 cases died of hemiplegia, 2 of meningitis, 2 of cerebral tumour, 1 of cerebral gumma, and 1 of myelitis. The incidence of G.P.I. and tabes in this series must be regarded as below the normal, since a proportion of the cases was not observed for more than five years, and the maximum period of observation was only twenty-five years. Glaeser held that only 2.2 per cent of syphilis cases develop tabes. Matthes³⁵ investigated 698 out of 1570 syphilitics who attended the Jena clinic from the year 1860, and found that, of those whose infection dated back more than twenty-five years, tabes and paralysis accounted for 3.6 per cent. In the series were also 1 case of myelitis and 2 of cerebral syphilis. Besides these, 10 out of 18 deaths from apoplexy occurred before the fiftieth year, and were therefore probably due to syphilitic arteritis of cerebral vessels. Süssengluth³⁶ investigated the later histories of 297 syphilitics, and found that after twenty-four years 4.7 per cent had developed G.P.I. and 2.5 per cent tabes.

The investigations by different workers into the causes of death of insurance-policy holders, which are shown in *Table II*, appear to indicate that Mattauschek and Pilez's percentages of G.P.I. and tabes are by no means too high.

Thus, even amongst the general body of deceased policy holders, the percentage of deaths from G.P.I. was found to be no less than 1.4 per cent by Byrom Bramwell, and as high as 3.9 per cent by Blaschko and Jacobsohn, while deaths from tabes varied from 0.16 to 0.8 per cent of the whole, and aneurysm accounted for 0.4 to 0.6 per cent. When the causes of death of those insured who declared syphilis on taking out their policies are considered, the percentages of deaths due to G.P.I., tabes, and aneurysm are found to be far higher than those discovered by Mattauschek and Pilez and by the authors mentioned above, who followed the plan of tracing out histories of syphilitics.

In regard to other nervous diseases, the exact relation of syphilis to insanity apart from G.P.I. is not known, though it is recognized that syphilitic meningitis, arteritis, and gumma sometimes cause insanity which clears up under treatment. According to an investigation carried out under the auspices of the Royal Commission on Venereal Disease, 10.2 per cent of 505 non-paralytic insanes in fourteen English asylums gave a positive Wassermann reaction, and out of 951 insane non-paralytic cases examined under Mott's direction by Candler and Mann, 8.4 per cent were positive. But Sir John Collie's investigation of 500 apparently healthy male adults resulted in 9.2 per cent positive reactions, and Fildes' investigation of the Wassermann reaction amongst 1002 apparently healthy adults gave

10·3 per cent positive in males, and 5·1 per cent in females.³⁷ These figures indicate no greater rate of syphilis amongst the non-paralytic insane than amongst the adult general population, though Mattauschek and Pilcz's 80 cases of insanity represent a high percentage of the whole number, especially when the 83 who committed suicide are remembered.

Table II.—ANALYSES, BY DIFFERENT WORKERS, OF THE CAUSES OF DEATH OF POLICY HOLDERS IN A NUMBER OF INSURANCE COMPANIES.

Author and source of information	No. of deaths analyzed	No. who acknowledged having had syphilis	Percentages							
			G.P.I.	Tabes	Brain & spinal cord disease certainly syphilitic	Brain & spinal cord disease probably syphilitic (e.g., apoplexy under 50)	Heart disease most probably syphilitic	Aneurysm	Total considered by author	
									Certainly due to syphilis	Probably due to syphilis
Runeberg, Finnish policy holders - - -	734	78	3.0	2.9		0.27	4.2	0.27	11.4	3.6
Tiselius, Scandinavian policy holders - - -	850	850	10.2	1.0	1.5	15.2	4.3	3.4	17.6	29.9
Blaschko and Jacobsohn, German policy holders {	150	150	24.0	6.6	2.0	5.3	2.0	2.6	33.0	18.0
Kleinschmidt, German policy holders - - {	5574	0	3.9	0.7	—	—	—	0.6	5.2	7.7
Parkes Weber, English policy holders - - -	88	88	18.1	4.5	—	9.0	9.0	2.27	51.0	—
Byrom Bramwell, British policy holders - - -	2415	0	2.9	0.58	—	2.76	0.87	0.41	7.5	—
	500	3	2.0	0.8	—	1.4	1.4	0.4	3.6	6.0
	3658	—	1.4	0.16	—	—	—	0.64	1.5*	—

* Based on 75 per cent of tabes and G.P.I. and 50 per cent of aneurysm.

The incidence of recurrences in the cardiovascular system which was discovered by Mattauschek and Pilcz is indicated in Table III, which is an analysis of the causes of death of the whole number, especially when the 83 who committed suicide are remembered.

Table III.—ANALYSIS OF THE CAUSES OF DEATH OF 492 OFFICERS OUT OF 546 WHO DIED OF OTHER AFFECTIONS THAN THOSE SHOWN IN Table I.

Year	Tuber- culosis	Suicide	Myo- carditis	Apo- plexy	Aneur- ysm	Arterio- sclerosis	Chronic nephritis	Acute nephritis	Cirrhosis of Liver	Syphilis	Cancer	Other diseases
1-10	93	60	12	3	2	1	1	4	3	15	5	41
11-20	45	22	16	16	11	2	8	—	9	5	15	40
21-30	8	1	6	12	4	3	4	1	—	—	2	12
31 and over	1	—	1	3	—	1	1	—	—	—	1	2
Totals	147	83	35	34	17	7	14	5	12	20	23	95

Aneurysm is the disease which can most surely be connected with syphilis. In Mattauschek and Pilcz's statistics it appeared to be about one-seventh as frequent as general paresis. In Table II, which relates to policy holders, the proportion varies from one-third to one-tenth. These would be low proportions if applied to the general population of this country, since the deaths from general paresis, tabes, and aneurysm respectively in Scotland for the ten years ending 1910 were 2204, 701, and 1490; in Ireland for the same period they were 761, 425, and 578; and in England and Wales for 1911-2 the mortality-rates per million of population were, general paresis and tabes combined, 80; and aneurysm, 32.³⁸ In 1913 the deaths from general paresis, tabes, and aneurysm respectively in England and Wales were 2140, 732, and 1155; and in 1919 they were 1608, 663, and 891. The difference between the relationship of aneurysm to tabes and general paresis disclosed in these figures and those shown in Tables I, II, and III might be explained by the fact that the statistics in these tables relate to better classes, less subject to physical strain, and more to mental strain, than the average of the population.

Syphilitic myocarditis caused death in about 1 per cent of Mattauschek and Pilez's cases, or about twice the number of aneurysms. Other analyses make the mortality from myocarditis (diagnosed chiefly on the strength of cardiac failure under the age of 50) from two to four times that of aneurysm. Thus Weber, in 500 deaths amongst policy holders, found 2 from aneurysm and 7 from heart-stroke. Kleinschmidt, in 2503 deaths, found 12 from aneurysm and 29 from heart failure under 50.

Opinions differ as to the effect of syphilis in shortening life. Gollmer³⁹ found, in an analysis of 1778 syphilitic lives insured in the Gotha Life Insurance Company, a mortality at all ages of 68 per cent above the average, with 86 per cent from ages 36–50. In 5175 syphilitics insured in Scandinavian companies, with 848 deaths, the mortality averaged 28.5 per cent above the normal for all ages and about 42 per cent for ages 41–60. Thirty-four American companies, in an experience of 397 deaths amongst 5385 syphilitics insured, showed an average extra mortality of 33.3 per cent, with 53 per cent for ages 43–56. Kleinschmidt found that the average age at death of 88 policy holders who declared syphilis was 47.5 years. The average of syphilitic policy holders who did not declare syphilis was 45 years. The average of all policy holders at death was 48.5 years. This makes a shortening of life from syphilis of 1 to 3.5 years. Byrom Bramwell found in 3658 deaths of policy holders that the expectation of life of a syphilitic was reduced by 1.3 years on account of syphilitic general paralysis, syphilitic tabes, and syphilitic aortic aneurysm. If he developed any of these, his life was shortened by 18 years. As Bramwell counted only 75 per cent of all his cases of tabes and G.P.I. and 50 per cent of aneurysm as due to syphilis, and he excluded all cases of apoplexy, and of cardiac, kidney, and liver disease, it is clear that the expectation of life by a syphilitic must be reckoned as more than 1.3 years shorter than the average.

Some mention must be made of the effect of syphilis in predisposing to tuberculosis. Matthes³⁵ found that, out of 114 deaths amongst 568 secondary cases, 36 were due to tuberculosis; and out of 46 deaths amongst 130 tertiary cases, 7 were due to the same cause. In *Table III* are shown 147 deaths from tuberculosis out of 492 from all causes, and 93 of them within the first ten years. The mortality from tuberculosis in this series must be accounted high, as the subjects were selected lives. Pick and Bandler found that, out of 191 deaths in 2067 syphilitics, 64 were due to tuberculosis of the lungs, but point out that this high mortality was possibly due to the mode of life of the subjects, many of whom were prostitutes. Also it may be noted that the mortality from tuberculosis seems to be high in Bohemia (about 35 per 10,000 for all ages, against 13–14 in England). Many authors have expressed their belief that syphilis predisposes to tuberculosis, notably Neisser, Hutchinson, and D'Arcy Power. Other workers are not so sure that the mortality from tuberculosis is greater amongst syphilitics than the general population. It must be remembered that tuberculosis causes a very high proportion of all deaths amongst the general population. Thus the deaths from all causes in persons aged 15–45 in England and Wales for 1911–3 inclusive were 244,413, and of these 80,366 were from tuberculosis, a proportion which is not very different from that found by the authors quoted above in subjects of about the same ages. Altogether it seems reasonable to agree with Dyce Duckworth that the question is one for further consideration.

The effect of syphilis on the mortality of infants before and after birth has been investigated by comparing the experience of syphilitic families with those of the general population as regards abortions, miscarriages, still-births, and deaths shortly after birth. N. Bishop Harman⁴⁰ compared the history of 150 families in which syphilis was known to have been transmitted with that of 150 families of the poorest classes. In the syphilitic families there were 1001 pregnancies, resulting in 92 miscarriages, 80 still-born infants, 229 infants' deaths, 210 diseased infants, and only 390 healthy children. In the ordinary families were 826 pregnancies, resulting in 61 miscarriages, 17 still-born infants, 94 infant deaths, and 654 healthy children. Thus the *net* result in healthy children was 2.6 per syphilitic family and 4.3 per average family. H. C. and M. H. Solomon⁴¹ investigated 555 families of late syphilitics. Of the 555 families, 29.7 were childless (including 6.7 per cent with unsuccessful pregnancies). This compares with 11.3 per cent childless families of the same type of *general* population and age of mothers. The average birth-rate per syphilitic family was 2.05, and the average number of living children 1.62. The average birth-rate per family of the general population of the same district was 3.8. Of

the children of the whole 555 families, 12·8 per cent gave a positive Wassermann reaction, but in the 236 families included in the above in which the mothers were proved to be syphilitic, 27·5 per cent of the children were positive. Contrary to the usual findings, the authors did not discover a higher infant mortality in their syphilitic families, where it was 124 per thousand, than amongst the general population of the same district. Of the 1432 pregnancies in the syphilitic group, 20·7 per cent failed to produce a living child. This compares with the 17·1 per cent discovered by Harman. On the other hand, in apparently non-syphilitic families, Jeans⁴² found only 9·7 per cent of failures in 886 pregnancies; Harman only 9·4 per cent of 826 pregnancies; and Duke⁴³ 7·7 per cent of 5808 pregnancies.

In the absence of an accurate estimate of the syphilis rate amongst the general population, it is impossible to state how frequently members of the families of syphilitics suffer later from the effects of syphilis. Harman's study (*loc. cit.*) is valuable as a guide to the incidence of the various syphilitic eye defects relatively to one another. In 1100 children attending schools for the blind in London he found, due to syphilis, 191 interstitial keratitis; 125 optic atrophy, with or without disseminated choroiditis; 6 iritis; 5 buphthalmia; 2 albinism; and 14 cataract; making 343 cases, or 31·2 per cent of all the serious eye defects in London school children attributable to congenital syphilis. Out of 222 cases of optic atrophy from all causes, 64 were found to be mentally defective, either during or after the school year, and 51 of these were syphilitic. Incidentally it may be mentioned that, in 40,000 elementary-school children examined in 1903 to 1906, he found that 1 in 5000 showed the after-effects of syphilitic eye disease, viz., interstitial keratitis. At the same rate the total number of eye defects due to syphilis amongst the approximately 790,000 London children under 14 years of age would work out at about 158 in elementary schools + 343 in blind schools, or about 1 case in 1580 of the school population.

Modifications of the Prognosis by External Agencies.—

Effect of Specific Fevers on the Incidence of General Paresis.—It has been suggested by various authors that a specific infectious fever during the first year of infection lessens the chances of G.P.I. developing later. Mattauschek and Pilez found 241 of their officers with such a history, and none of these subsequently developed paresis, but 7 suffered later from tabes and 8 from cerebrospinal syphilis.

General Measures for the Maintenance of Health.—As affecting the possibility of recurrences, the importance of damage and overstrain cannot be emphasized too strongly. In common with probably every syphilologist, I have been struck by the frequency with which syphilis recurs in the damaged spot. The injury has often been comparatively trivial, but its relation to the development of a recurrence there shortly afterwards has been too close to be a mere coincidence. Two good examples are the following: A patient ran a thorn into his hand; very shortly afterwards a nodular cutaneous syphilide commenced at the site of the injury and spread gradually over the whole palm. A patient was struck by a small fragment of shell on the inside of the thigh. The blow did not produce a visible bruise, but a nodular cutaneous syphilide, which grew to a three-inch circle, commenced on the site of the blow, and was the only sign of recurrence which the patient had observed for nearly twenty years. Leucoplakia of the tongue and cheeks occurring in smokers or drinkers is another example of this tendency of syphilis to recur in damaged areas, and it is of interest to note that various observers have remarked on the increase of tertiary recurrences in a community which is suffering great hardship. It is reasonable to believe that the same general rule as to recurrence of syphilis in the damaged or overworked spot applies to viscera and the central nervous system, and the lesson from it is that, other things being equal, the patient who leads the healthiest life, and abuses his tissues the least, is the most likely to escape recurrences.

The Effect of Treatment in Preventing Recurrences.—Opinions differ. Fournier and Hutchinson were strongly of opinion that well-treated cases suffered less from recurrences than those in whom the treatment had been neglected. On the other hand, many instances have been cited of patients who have developed such late manifestations as aneurysm, tabes, and general paresis in spite of having received what was termed early and thorough treatment. It is difficult, however, to define what is thorough treatment of a case of syphilis. After mercury had been used for centuries, opinions were still divided on this point, and when Hutchinson considered two years' treatment sufficient, Fournier's ideally-

treated patient was taking mercury in the eighth year; so that, when authors cite instances of the failure of thorough treatment to prevent tabes and general paresis, we have first to learn what, in these cases, was that treatment which was termed thorough. The wide experience of Fournier, Neisser, and Hutchinson lends considerable weight to their opinion that the more energetic and prolonged the treatment, the less likely the recurrence. This is supported by Mattauschek and Pilez (*loc. cit.*), who found that, of those who had received no treatment, 25 per cent had developed general paresis; of those who had been treated with one course of mercury, 23.14 per cent; and of those who had been treated energetically and repeatedly, 3.28 per cent. Neisser's statistics to the end of 1895 showed that 68.8 per cent of his male cases, and 76.8 per cent of his female cases who had been badly treated, or not at all, had developed tertiary symptoms, while the percentage of tertiaries amongst those who had received two or three courses of mercury was 8.9 men and 5.8 women. A consideration of the statistics furnished by numerous other workers also compels the belief that, although no absolute guarantee against recurrences was given by mercurial treatment, the more thoroughly this was carried out, the less chance there was of the patient suffering from any further clinical manifestation.

Granted that thorough mercurial treatment lessens the chances of future clinical recurrences, the question arises as to how much arsenobenzol treatment augments its effects. The opinion has already been given that it has had the effect of reducing the incidence of recurrences in the framework and the testes. The question as to the effect of arsenobenzol treatment in preventing the later development of recurrences in the viscera and in the cardiovascular and nervous systems cannot yet be answered. With regard to the viscera and cardiovascular system it seems reasonable to expect that the present-day treatment will be found to have reduced the incidence of later syphilitic manifestations considerably, and particularly so in cases where a positive Wassermann reaction of the blood has been regarded as an indication for continuing or resuming treatment. This expectation is based on the known powerful effect of arsenobenzol treatment on such somatic lesions (excepting interstitial keratitis) as can easily be watched. The case of the nervous system, however, is different. In the early days of arsenobenzol therapy we had a rude reminder that absence of somatic recurrences, even with a negative Wassermann reaction, is no guarantee against recurrences in the nervous system, as a large number of cases of relapse were reported with such signs of syphilitic meningitis as paralyses of various cranial nerves and, less commonly, meningomyelitis. In many of these cases the Wassermann reaction of the blood was negative, and it has been suggested that the lesions in the central nervous system were the more severe from the fact of the organism of syphilis having been suppressed in the somatic tissues, and consequently the development of immune substances which would have kept the spirochætes lodged in the central nervous system in check. With the increase in the amount of treatment which followed this lesson, neuro-recurrences with symptoms have become very rare; in the few cases which I have seen in the past six years the previous treatment has been comparatively trifling, and it seems likely that, as it becomes more generally recognized that the first negative Wassermann reaction of the blood does not herald the death of the last spirochæte in the patient's tissues, and it becomes the custom to prolong the treatment far beyond this stage, we shall see less and less of syphilitic recurrences in the supporting and nutrient structures of the central nervous system. A further guarantee of freedom from later recurrences in the nervous system is afforded by the systematic examination of the cerebrospinal fluid during and after the completion of treatment. Ravaut⁴⁴ recommends that a lumbar puncture should in any case be carried out during the fourth and about the tenth years. It is reasonable to expect that timely treatment, instituted on the discovery of fluid changes, will have a definite effect in reducing the proportion of cases which develop nerve symptoms. Whether this can be said of syphilis of the parenchyma of the brain and cord cannot be stated, and the same applies to the effect of modern treatment in preventing the development of later recurrences in hereditary syphilis.

The Effect of Treatment on Recurrences in the body framework has already been described as good. In visceral and cardiovascular disease, the diagnosis is so often made at a late stage that any good effect is apt to be obscured by the damage already done, e.g., in aneurysm of the aorta and interstitial hepatitis. In syphilitic meningitis and endarteritis of the vessels of the central nervous system, early arsenobenzol treatment has, in my

experience, given most brilliant results, but very prolonged treatment is necessary to render the cerebrospinal fluid normal. Naturally, if the nerve tissue has become hopelessly damaged before treatment has been commenced, the signs of the damage will remain. This is particularly apt to happen in transverse myelitis and in cranial-nerve paralyses. The amount of permanent damage can be judged only after prolonged treatment.

The manifestations of *hereditary syphilis* are generally very amenable to treatment by arsenobenzol and mercury. Much depends on the condition of the infant when treatment is commenced, and this varies very greatly. In those born with syphilitic pemphigus the outlook is bad, and the same applies to those with extensive involvement of the viscera and nervous system. Average cases with symptoms commencing a few weeks after birth usually do well. In the manifestations of the later stages of childhood and adolescence the outlook is similar to that in corresponding manifestations of acquired syphilis. Interstitial keratitis is notoriously resistant to treatment, and nothing is more disappointing than to see the second eye becoming affected after the patient has been under arsenobenzol and mercurial treatment for some weeks.

III.—THE RISKS OF TREATMENT.

The risks of treatment are mainly those due to arsenobenzol injections. Mercury may cause nephritis, stomatitis, colitis, and general malaise when pushed; but it is not now necessary to administer it so intensively as in pre-salvarsan days; so that, under ordinary precautions, there is very little to fear from this remedy. The arsenobenzol compounds give rise in susceptible subjects to four main toxic effects which menace the patient's life. These are multiple capillary hæmorrhages with œdema in the brain (encephalitis hæmorrhagica), hæmorrhagic nephritis, exfoliative dermatitis, and destruction of the liver parenchyma.

Encephalitis hæmorrhagica (and sometimes hæmorrhagic nephritis) found in subjects who have died in coma following convulsions is very uncommon. I have been able to find only 10 cases amongst about 100,000 soldiers treated with arsenobenzol compounds during the war. It occurs from one to five days after an injection, and has most frequently followed the second injection. It was commoner in the early days of salvarsan, when it was the custom to give two doses of 0.6 gm. '606' at a very short interval, and I believe that the comparative rarity of these accidents now is due to reduction of the initial doses.

Dermatitis of various degrees of severity, from mild erythema to severe exfoliative dermatitis, occurred in about 0.9 per cent of syphilitic soldiers treated during the war, and in a series of 39,377 cases of syphilis accounted for 18 deaths. Its severer degrees are largely, though not entirely, preventable by judicious spacing out of the injections, and by care as to suspension of treatment on the first signs of erythema. Dermatitis may, however, develop as long as a month or even nine weeks after the last injection of a course. Acute exfoliative dermatitis is an anxious complication, though most cases recover after a long illness. The patient may die of bronchopneumonia, enteritis, toxæmia, or marasmus.

Hepatic disorders occurred in 0.6 per cent of 39,377 cases treated during the war. Most of the cases were mild, and similar in clinical features to ordinary obstructive jaundice, but in this series were 24 deaths from acute yellow atrophy of the liver. These cases seemed to occur in small epidemics, a feature which has been noted by other writers, and the exact connection of arsenobenzol treatment with acute yellow atrophy of the liver is not yet settled. It appears likely that the arsenobenzol is a factor, but the evidence seems to point to other agencies also playing a part.

Altogether, it may be said that, with care as to dosage and a close look-out for warning signs, the risks of treatment are very slight; nothing, at any rate, to the risks of non-treatment.

IV.—THE RISK OF TRANSMISSION.

1. **By Social Intercourse.**—The organism of syphilis has a very short life outside the body under normal conditions, and it seems probable that infection is conveyed by almost immediate inoculation. Otherwise, when we consider the numbers of syphilitics with open lesions frequenting restaurants, using public conveniences, and living in the midst of their families, one would expect extragenital chancre to be much commoner than it is. The chances of the disease being passed on in this manner probably depend largely

on the patient's social surroundings. Where individuals are crowded together and have not that instinctive distrust of other persons' secretions (especially saliva) which prevails in highly civilized communities, extragenital syphilis is common. Thus V. Bellousow states that, in certain parts of Russia, 74 to 78 per cent of the syphilis is acquired extragenitally. On the other hand, the statistics of the Hôpital du Midi⁴⁵ showed 30 out of 481 chancres in men to be extragenital. Hahn,⁴⁶ from a very large amount of material, estimated the extragenital infections in Germany, France, and Denmark at 4.5 to 5.5 per cent. White and Brown found in British soldiers during the war that 0.91 per cent of the 9000 cases in which the primary sore could be located were extragenital infections.

2. By Sexual Intercourse to the consort. All authorities are agreed as to the great risk of transmission during the early years of the disease. The chances diminish considerably after the second year, and transmission is very uncommon after the fifth year, though the disease may not be cured. Fournier⁴⁷ mentions 87 men who married at varying periods (from one to eleven years) after contracting syphilis. In no case was the disease transmitted, though many of the 87 subsequently suffered from recurrences. Although transmission to the consort is rare after the fifth year, cases have been recorded after eleven, fourteen, and even twenty years. Browning⁴⁸ quotes an account of a case recorded by Trichinese which seems to show that conjugal infectivity may last a considerable number of years, and may be influenced by treatment. A patient infected eight years previously was treated by a course of mercurial inunctions because of a positive Wassermann reaction. He then married and had two healthy children, the wife's blood remaining negative. Ten months after the birth of the second child, the mother developed a secondary rash, and her blood gave a positive Wassermann reaction. The father's blood was positive the whole time, but the chances of the mother having contracted syphilis from another source are not excluded. There is considerable evidence to show that thorough treatment reduces considerably the chances of transmission to the consort even in the earlier years of infection. Thus Gennerich⁴⁹ mentions a number of cases of men who married within two years and had healthy families. J. Hutchinson considered that two years' treatment by mercury was sufficient in most cases to ensure safety from transmission to the consort. This opinion was not shared by the Paris school, which laid down a minimum probation period of five years. It seems reasonable to expect that with the more powerful arsenobenzol treatment the period of probation can be shortened considerably; but since a patient can remain clinically and serologically latent for two years and then relapse, a patient who marries within five years of infection ought to remain under close observation until at least the end of the five years, and would be safer if treated intermittently throughout that period.

3. Transmission to the Second Generation depends generally on infection of the mother. Even if one believes in the possibility of paternal infection of the ovum, it is difficult to believe that a mother would escape infection from her syphilitic foetus, since we know that a mother is herself liable to transmit to her children long after ceasing to be contagious to her consort. As a matter of fact, the belief in paternal infection rests largely on records of 'healthy' mothers of syphilitic children; but a very large percentage of these 'healthy' mothers give a positive Wassermann reaction, and Colles's law that a syphilitic infant does not infect its mother is very strong evidence that the mother is already infected. Once a woman has become infected, she is liable to transmit the disease to her unborn children for many years after she has ceased to be contagious to an uninfected consort. Thus J. Hutchinson relates the case of the father of a syphilitic infant (born some years after the infection of the mother by another man) who contracted syphilis on a tonsil by sucking the child's rubber teat. There is some evidence to show that, if a mother is infected after the seventh month of pregnancy, the child may escape.

Although the tendency to transmit to the second generation generally decreases with successive pregnancies, and the disease becomes progressively milder in successive children, this is by no means the invariable rule, and apparently healthy children may be succeeded by abortions, miscarriages, still-births, and badly diseased infants, in a most irregular manner throughout a family. It has even happened that, of twins, one was obviously syphilitic and the other apparently healthy.

There is universal agreement as to the effect of treatment of the mother in preventing transmission. If this commences after conception it is treatment of the foetus rather

than prevention of transmission, and this gives no certain guarantee against recurrences in the child's later years; so that the ideal is thorough treatment of the mother before conception, until there are reasonable grounds for believing the disease to have been eradicated, and a very close watch throughout the child-bearing period.

Transmission to the Third Generation.—A few instances have been recorded of transmission by congenital syphilitics to their children, but the possibility of the infecting parent having acquired syphilis does not appear to have been excluded in these cases, and the question must remain undecided. In any case transmission to the third generation must be very rare.

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L. W. Harrison.

SYPHILIS, CARDIAC.—(See CARDIAC SYPHILIS.)

SYPHILIS OF STOMACH.—(See STOMACH, MEDICAL DISEASES OF.)

SYPHILITIC JOINTS.—There are three varieties of syphilitic joint disease not infrequently seen:—

1. **Acute Syphilitic Epiphysitis**, the so-called syphilitic pseudoparalysis of infants. This indicates a severe type of the disease which may be fatal, but if other signs are not very extensive, the joints recover well under mercurial treatment.

2. **Synovitis of Older Children**, the painless hydrops of the knee which occurs in children from six to sixteen, often with interstitial keratitis. It usually clears up completely under treatment in the course of weeks or months, but in one boy under my care double fibrous ankylosis had resulted.

3. **Gummatous Arthritis**, the so-called 'white swelling' of joints with tertiary acquired syphilis, usually met with in adults, and most frequently affecting the knee. Unless treatment is very early and thorough, these cases are apt to get a stiff knee, which may also be painful; and in one or two instances which the writer has seen, a good result was not obtained until the joint was excised.

A. Rendle Short.

SYPHILITIC MENTAL DISEASE.—(See MENTAL DISEASES.)

TABES DORSALIS. (See also ATAXIAS).—The outlook in cases of tabes dorsalis depends, to a large extent, upon the stage at which the disease is first recognized. By the time the patient has become ataxic in his gait, with absent knee-jerks and bladder trouble, the disease is already well advanced; and if, in addition, there are trophic

changes in the skin or joints, gastric or other crises, and evidences of cystitis, the prognosis is correspondingly worse.

It is, therefore, highly important for the physician to recognize the disease in its early or pre-ataxic stage, when the patient is still able to walk and stand securely, and when the chief, and perhaps the only, symptoms consist in paroxysmal lightning pains, generally in the limbs: these pains are often mistaken for rheumatism, since they are aggravated by cold or damp weather. Or the earliest phenomenon may be some transient ocular palsy, with diplopia, squint, or ptosis. It is commonly stated in text-books that the diagnosis of tabes in the early stages is established by the combination of lightning pains, reflex iridoplegia, and loss of knee-jerks. But it is generally possible to make a diagnosis long before the knee-jerks are lost. In many cases, the ankle-jerks disappear whilst the knee-jerks are still quite brisk. The diagnostic significance of loss of ankle-jerks is therefore of the utmost value. Most important of all is the presence of lymphocytosis of the cerebrospinal fluid. This is the earliest and most constant physical sign in tabes (as in general paralysis), and should be looked for in every doubtful case. It precedes all the other signs and symptoms.

The course of tabes, as a whole, apart from special complications to which we shall refer later, is steadily downwards; the patient's power of walking grows gradually worse, the ataxia being often apparently aggravated by the violence of his own efforts. Some cases become severely ataxic in the course of a couple of years after the onset of the first symptoms. In others, the disease progresses much more slowly, and the patient may remain in the pre-ataxic stage for many years, complaining only of occasional lightning pains. In others, again, the disease becomes spontaneously arrested at a somewhat later stage, and the patient, already ataxic, gets about for an apparently indefinite time. Some of the symptoms, such as pains, early ocular palsies, and various visceral crises, may disappear as the disease advances; but once the patient has become ataxic, his inco-ordination persists, though it may sometimes be alleviated, e.g., by means of special courses of exercises.

Tabes does not necessarily shorten life, and it has been truly said that many a tabetic patient outlives his physician. A few cases, however, run an extraordinarily rapid course, and may become bedridden within a couple of years, or even less. Thus, I recall the case of a man who acquired syphilis at the age of twenty-three. His first tabetic symptom was that of transient squint at thirty-one. This cleared up completely in a fortnight. At thirty-three he developed deficient sensation in the lower limbs and along the ulnar borders of both upper limbs. A month later, the first signs of ataxia of the legs appeared, and within six weeks he became unable to stand or walk.

The presence or absence of bladder trouble has an important bearing on the prognosis of tabes; and of all the complications, this is one of the commonest, and one which has a truly serious import. Cystitis, in tabes, is secondary to chronic dilatation of the bladder; this dilatation, again, is the result of deficient sensation in the organ, so that the patient does not realize when his bladder is distended, and may even pride himself upon the length of time during which he is able to hold his water. If the bladder becomes habitually over-distended, its contractile power diminishes, and a residuum of urine remains after micturition. This residual urine gradually increases, and ultimately becomes so large in amount that the imperfectly-contracting and dilated organ develops overflow incontinence. Either at this stage, or earlier, the use of a catheter becomes necessary; and the patient's life now depends upon the precision with which an aseptic technique is carried out from day to day. Sooner or later the bladder becomes infected, and the patient is now in a still more critical stage, his danger being that of an ascending infection to the kidneys, with a terminal pyelonephritis. This gloomy sequence of events, however, is fortunately preventable if, at the very onset of the disease, as soon as we have made our diagnosis, we instruct the patient to empty his bladder at short intervals of three or four hours, day and night, independent of any spontaneous desire to do so, and without waiting for any sensation of distention. If the bladder is never permitted to become distended, dilatation is prevented; and the necessity for catheterization, with the subsequent chain of complications above referred to, is avoided.

Tabetic atrophy of the optic nerve, with progressive failure of vision, has an important prognostic significance as regards the course of the other tabetic symptoms.

In cases with blindness from optic atrophy, the ataxic symptoms are sometimes absent for many years; so that the patient, although blind, is able to walk steadily, and to use his upper limbs for fine movements of various sorts, such as typewriting, etc.

The various crises (gastric, intestinal, etc.) usually occur comparatively early in the disease. During the course of a crisis, with its urgent pain and intractable vomiting, the patient may become intensely collapsed; but the symptoms often cease suddenly, and recovery then takes place rapidly, usually within a few days.

So-called laryngeal crises are generally of the nature of exacerbations of a chronic bilateral abductor palsy, to which is superadded some slight spasm or hyperæmia of the larynx, producing urgent dyspnœa. The prognosis of such attacks is correspondingly grave, and unless promptly relieved by tracheotomy or intubation, the attack may actually prove fatal.

Perforating ulcer on the plantar surface of the great or little toe, or on some part of the sole of the foot, is a painless trophic affection which may occur early in the course of the disease. Formerly it was taught that perforating ulcers progress from bad to worse, ultimately producing an ulcer or sinus leading into the subjacent joint, or even resulting in gangrene and necessitating amputation. This, however, is not necessarily the case. Rest in bed for a few weeks, and simple antiseptic dressings, will produce healing of the great majority of such ulcers. Even where the bone or joint beneath the ulcer has been implicated, a bony sequestrum may come away, and the superjacent tissue may then cicatrize.

Tabetic arthropathies—so-called Charcot joints—occur most frequently in the knee, hip, or foot, but may affect the joints of the upper limbs, or indeed any joint in the body. They are often multiple, and sometimes symmetrical. The outstanding characteristic of this variety of joint affection is its painlessness. Not only is the initial effusion into and around the affected joint unaccompanied by pain, but even when destructive changes are far advanced, with loss of articular cartilage, coarse crepitus between the bare ends of the bones, and abnormal mobility of the joint from relaxation of its ligaments, the patient still suffers no pain. After the affection has persisted for weeks or months, it will be observed that the joint changes are not purely destructive, but that a certain amount of bony hypertrophy occurs in the neighbourhood of the affected joint, producing osteophytic outgrowths at the margins of the articular ends of the bones, and often resulting in huge bony masses in which the original outline of the bones becomes completely buried, as if it were nature's attempt to immobilize the diseased joint.

Spontaneous fractures of the bones, in tabetic patients, chiefly occur in the long bones, and often in the neighbourhood of a joint which is already the seat of a tabetic arthropathy. These fractures occur spontaneously, i.e., after inadequate or trivial causes. They are absolutely painless, and unless the mechanical conditions be such as to render locomotion impossible, the patient may continue to use the broken limb without any consciousness of what has occurred. The prognosis as to union of such fractures is good, as a rule. Most cases become firmly reunited, but with an excessive amount of callus.

Although ataxia is present in a large proportion of cases, it is not necessarily an early symptom; many tabetics suffer from the disease for years without developing it. There seems to be little doubt that physical exertion tends to precipitate its occurrence. If, therefore, we establish our diagnosis in the pre-ataxic stage of the disease, we may sometimes succeed in retarding, or possibly in warding off completely, the onset of ataxic symptoms, by impressing on the patient the necessity for abstaining carefully from severe or prolonged muscular exertion. Thus, for example, the amount of walking he is permitted to do should never be enough to induce the slightest fatigue.

Once ataxia has supervened, it may either become slowly and insidiously worse, or it may remain for years practically of the same degree of intensity. Or again, in other cases, it may attain to an extreme degree with extraordinary rapidity, within a few weeks, or even days. An acutely-advancing ataxia of this sort is aggravated by the very energy with which the patient strives to overcome it.

In some cases the ataxia may even improve; and the patient, previously unable to stand or walk, may, by practising carefully-planned exercises under supervision, re-educate his limbs and become able to walk once more with only a moderate degree of ataxia. The cases which are most likely to benefit from such a course of re-educative

exercises are those in which the disease has advanced slowly and gradually. In patients with ataxia of rapid onset, it is wise to wait until the ataxic phenomena have apparently ceased to advance, before commencing re-educative exercises. *J. Purves Stewart.*

TACHYCARDIA.—(See PULSE, IRREGULARITIES OF.)

TALIPES.—The prognosis in congenital and paralytic talipes must be considered separately.

Congenital Talipes Equinovarus.—There is no tendency to spontaneous improvement; indeed, unless carefully watched, the case is liable to relapse after operation. Untreated cases are generally able to walk, but in a very painful and cumbrous manner, lifting one foot over the other at each step.

Given proper treatment before the child has learnt to walk, it will be possible, in the milder degrees of the deformity, to obtain a perfect result; but not if there is great rigidity or bony alteration. Almost any case can be got into good position if treatment is commenced immediately after birth and persevered with. If treatment begins after walking, it is often possible in the milder cases, or in patients with rigidity in a bad position not due to bony change, by means of tenotomy and plaster, to get a foot which, if unshapely, will be sound functionally. If there are bony changes, it will be necessary to excise the astragalus or a wedge from the os calcis and cuboid. Albee suggests the insertion of a wedge bone-graft on the inner side of the foot. Some pain on walking far, and permanent deformity of the foot, must then be anticipated in most cases, although the operation will probably effect great improvement.

Much depends upon the patience and perseverance with which the parents bring the child for supervision. Up to the age of twenty there is a tendency to relapse, but the relapses can be cured. Care, therefore, is needed for months and years after any operation.

The methods of treatment are fortunately almost free from risk. Non-union of tendons after tenotomy is *very* rare, but sometimes a long, thin, weak bond of union may result. There are a few cases on record of aneurysm following nicking of the posterior tibial artery.

Paralytic Talipes.—It is almost always possible, both in children and adults, to obtain a shapely foot with plantigrade walking by means of tenotomies, tendon-transplantation, plaster, and orthopædic apparatus, but it is not possible to restore power to the paralyzed muscles after the lapse of a year from the onset of the infantile palsy. To this statement one qualification must be made: a muscle which has been long over-stretched may recover a good deal of its power if it is kept for several weeks in a relaxed position.

REFERENCE.—Tubby, *Deformities, including Diseases of Bones and Joints*, vol. i.

A. Rendle Short.

TENOSYNOVITIS.—

Simple.—This may be classified under four headings, *crepitating*, *serous*, *purulent*, and *adhesive*.

The two former are usually met with in the tendon-sheaths around the back of the wrist, and are harmless and transient affections, though there is a certain tendency to relapse. The duration depends upon the time at which efficient treatment is undertaken; if a splint is worn and iodine applied, it is uncommon for the trouble to last more than a couple of weeks.

Purulent tenosynovitis is most often met with in the sheaths of the flexor tendons of the fingers. It is very seldom dangerous to life, except in feeble or aged persons when it has rapidly extended to the larger sheaths around the wrist, and then gone on to destroy the bones or joints. Apart from this, however, suppuration in a tendon-sheath is a serious disease, because it is almost certain, unless the pus is let out very thoroughly and very early, that a stiff finger will result from *adhesive* tenosynovitis, and this is such an obstruction that, for many occupations, it is better to amputate the finger.

Tuberculous.—There are two principal varieties, the *pulpy* form, going on later to caseation and softening, and the *melon-seed-body* form, which runs a much more chronic course. There is no essential difference between them; the writer has found the pulpy

form in the extensor tendon and melon-seed bodies in the flexor tendon of the same finger, and also a mass of pulpy tissue at the wrist containing a few melon-seed bodies in the middle of the pulp.

The prognosis is not very satisfactory. In early cases, before softening and septic infection have occurred, healing is often to be obtained by fixation and, if this fails, by evacuation and scraping of the tendon-sheath, with the application of iodine, iodoform, or carbolic acid. But, unfortunately, the tendons may be stiff and adherent, or the tuberculous process may recommence at a distance, in the same or another sheath. When suppuration has already occurred on an extensive scale, especially if the joints are invaded, the prospects of useful recovery are usually so small that amputation is to be advised.

A. Rendle Short.

TESTIS, NEW GROWTHS OF.—The nomenclature of the new growths of the testis is very confused. The older authorities divided them into fibrocystic disease, sarcoma, and carcinoma, the first of which often contained cartilage, and was supposed to be innocent. Some modern writers (Nicholson, Morrision Davies, Russell Howard, Thomson Walker) deny that there are any innocent tumours of the testis, except the very rare dermoid cysts. The patient from whom Sir James Paget's original type-specimen of chondroma was taken eventually died of recurrence in the heart and lungs.

The classification given by Morrision Davies after Nicholson is :—

Embryoma	{ Solid
	{ Cystic (dermoids)
Carcinoma	{ Encephaloid (alveolar or non-alveolar)
	{ Scirrhus
Sarcoma (round-celled)	
Endothelioma. (Rare.)	

All these are described as malignant.

Ewing and American pathologists do not accept endothelioma, are doubtful as to the existence of sarcoma, and believe that every new growth of the testis (except some tiny adenomata) is an embryoma. Ewing classifies as follows :—

1. *Adult embryoma*, with definite rudimentary organs, brain, skin, teeth, hair, bowel, thyroid, etc. These may be congenital, are rare, run a slow course, are usually innocent, but may develop cancer.

2. *Teratoid tumours (mixed)*, fairly common, mostly malignant either as cancer or as sarcoma; contain cartilage, fibrous tissue, small cysts, etc. Form metastases in lymph-nodes.

3. *Embryonal carcinoma*, commonest. Soft, rapidly growing, very malignant. Mesoblastic elements can usually be found, showing that it is an embryonal cancer; when they are scarce, it has been classed as encephaloid carcinoma.

4. *Chorion-epithelioma*, also very malignant, with metastases in the lung.

5. *Chondroma*, probably a species of teratoma; may be innocent or malignant.

It should be mentioned that growths of the testis are very frequently confused with hæmatoceles, and that the patient may give no history of injury in the latter case. This must be borne in mind in giving a prognosis before operation.

The Operation Mortality of treatment by castration is very small except in broken-down individuals. At St. Bartholomew's Hospital, 2 out of 33 died as a result of this operation. From the literature, Kober reports 5 deaths in 106 cases after castration for sarcoma. The more modern procedure of opening up the retroperitoneal tissues about the bifurcation of the aorta and inferior vena cava in order to remove enlarged glands is no doubt a serious operation, the mortality in 44 cases collected by Hinman being 11 per cent.

The End-results of operation for malignant growths of the testis are very disheartening. The statistics in the table on the next page are available. They are all collections of cases from the literature, not purely hospital records, and are therefore likely to be unduly favourable.

In Kober's statistics (1900), 30 out of 48 followed were known to have recurred, and 3 more died within a year. In Chevassu's series, 81 out of 100 died within a few years. Many observers have been impressed with the great rapidity of recurrence.

Within a few months of the castration, there is a huge growth in the retroperitoneal glands. Nearly all the recurrences are in the glands, and take place within a year.

Codman reports a series of 56 cases operated on during forty years at one hospital—the Massachusetts General—most of them verified by the microscope. Of these, 13 were still alive, and 10 died of some extraneous cause, so that the comparatively large proportion of 41 per cent survived the disease. Perhaps a few of these were not malignant, as the records of some are very old.

Hinman, on the other hand, reporting on a series from Johns Hopkins Hospital, found 20 dead out of 24.

END-RESULTS OF CASES OF NEW GROWTH OF THE TESTIS
TREATED BY OPERATION.

Reporter	Operation mortality	Cases followed	Well over 3 years	Well under 3 years	Recurred or died
Butlin - - - - -	6 %	53	6	—	—
Kober (sarcoma) - - - - -	—	48	9	6	33
Chevassu - - - - -	—	100	19	—	81
Codman - - - - -	—	56	23	—	33
Hinman - - - - -	—	24	3	1	20
„ with removal of retro-peritoneal glands - - -	11 %	36	9*	11	16
Coley (majority also given toxins) -	—	60	7	5	48

* Over 2 years.

Coley records 60 cases treated for the most part by orchidectomy, followed sooner or later (usually not till recurrence) by his toxins. Of these, 7 were well three years and 5 for a shorter period, and 48 recurred or died. These figures put the treatment to a severe test, as they include many who had already recurred.

Microscopical details as to the cured cases are furnished by Chevassu, Hinman, and Coley, from which it appears that the pure cancers do better than the mixed-celled tumours. Coley's successful cases were nearly all 'sarcomata', but probably these were specially selected to send to him.

Growths of the undescended testis are likely to be diagnosed late, and do very badly.

We may conclude, therefore, that about a quarter of the patients with a growth of the testis will be saved by castration, that a few of these are of a quiet fibrocystic, cartilaginous, or adult-embryoma type from the first, and that even if recurrence takes place in the sarcoma group, Coley's fluid may pluck a few as brands from the burning.

In children, growths of the testis are ultra-malignant, and cure is practically never obtained. Tumours of the epididymis are very unfavourable. Operation is useless if the retroperitoneal glands can be felt enlarged.

Removal of Retroperitoneal Glands.—Of late years, in view of the very unsuccessful results just quoted, several surgeons have made a practice of removing the retroperitoneal glands around the bifurcation of the inferior vena cava and aorta. A patient was submitted to this operation recently at the Bristol Royal Infirmary (there was a remarkable contrast between the huge incision for the retroperitoneal removal, and the size of the one gland found, which was about as large as a filbert); but within a few months the patient returned with a large inoperable recurrence.

Hinman publishes a study of 44 cases in which this radical operation was carried out. Of these, 11 per cent died of the operation. About half the cases showed malignant involvement of the glands microscopically; as half of these again were inoperable, the operation was only really valuable in 25 per cent of the total number, which compares unfavourably with the high mortality, especially as it is so easy to fail to find every infected gland. Certainly, however, the end-results are promising, though not followed up long enough. The value of the operation is therefore still *sub judice*.

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A. Rendle Short.

TESTIS, TUBERCULOUS.—(*See EPIDIDYMITIS, TUBERCULOUS.*)

TETANUS.—Considerable progress in our knowledge of this disease has been made by the experiences of the Great War, the data collected by Sir David Bruce being particularly valuable.

Prospect of Acquiring Tetanus after a Wound.—It has long been recognized that clean wounds are seldom followed by tetanus, but that when the injury is earth-infected (particularly if the earth has been contaminated by animal faeces), is deep, suppurating, and contains dead tissue, there is a real risk that this terrible disease will supervene. In America, burns contracted in streets or gardens from fireworks on Independence Day have been a potent source of infection. The heavily manured soil of Flanders gave rise to a serious outbreak amongst the wounded in the early stages of the Great War. About 15 per cent of the wounds contained the bacilli. Some German and French figures, quoted by McConkey, go to show that of 83,000 wounded, before antitetanic serum came into routine use, 0·65 per cent developed tetanus. In the Franco-German war of 1870 the German figure is given as 0·36 per cent; in the Crimean war, amongst 12,000 English wounded, 0·15 per cent.

Both in animals and in man (Semple), intramuscular injections of quinine appear to have the property of lighting up the activity of tetanus germs buried in some old healed wound.

Wounds of the leg appear to be more likely to lead to the disease than those of other parts.

Wounds that are already granulating are not easily infected.

The commonest day to show symptoms is the tenth; after the third week the risk is very small, but a case has been recorded as late as 365 days after receipt of the wound (Bruce).

Prevention of Tetanus.—Tetanus may be prevented to a considerable extent by early and efficient treatment of the wound, and by giving a prophylactic dose or doses of antitetanic serum.

The most important factor in the treatment of the wound is the excision of damaged tissues, removal of foreign bodies, and provision of good drainage. By this means suppuration is controlled, and the nidus of the tetanus germ in dead muscle or clot removed. Antiseptics are of much less value. Carbolic acid (1–20) takes fifteen hours to kill tetanus spores; pure phenol is no better (Embleton). Eusol is said to kill in a few minutes. Hydrogen peroxide appears to be of some value.

There is clear evidence of the value of prophylactic injections of 500 units (U.S.A.) of antitetanic serum. Deaths from Independence Day tetanus rose to 417 in 1903. A campaign in favour of the use of serum injections for the burns was inaugurated by the American Medical Association, and the figure fell to 6 deaths in 1912 and 3 in 1914.

During the war the incidence of tetanus undoubtedly became much less when serum came to be used as a routine prophylactic. Wolf describes what he has seen in a stationary German field hospital on the Western front; before December, 1914, without antitoxin, 1·4 per cent of wounded developed tetanus; in the seven months following, all grenade and shrapnel wounds getting antitoxin, the incidence fell to 0·16 per cent. Far more cases of the disease were seen in England during September and October, 1914, than in the following months; but this may be partly due to differences in evacuation. Sir David Bruce has published an analysis of the case-mortality of patients treated in the home hospitals during the war, showing a marked fall after the middle of 1916, and another fall from the beginning of 1917. Many factors play a part in this; the patients were kept longer in France, and so the deadly type of tetanus with a short incubation period was less in evidence in the home hospitals; excision of the wound became routine treatment; and antitoxin was given much more systematically.

The immunity has been shown experimentally to last only about a week. The best method of prevention, therefore, is to give an injection of 500 units once a week for a month.

The serum treatment has certain drawbacks, especially when given by the intraspinal or intravenous routes. An urticarial rash several days later is common. If the serum is infected, suppuration may follow. If the patient has had horse serum—whether with

an antitoxin or otherwise—more than ten days previously, anaphylactic symptoms may follow, and two or three deaths are on record; this may be avoided by giving fractional doses.

There are cases recorded by Simon and others, of which the writer has seen one, in which within twenty-four hours the serum causes trismus, which looks very alarming. They recover in a day or two.

CASE-MORTALITY OF PATIENTS TREATED IN HOME HOSPITALS
DURING THE WAR.

Period	No. of Cases	Mortality per cent
1914-15 - - - -	231	58
1915-16 - - - -	195	49
Aug.-Oct., 1916 - - -	200	37
Sept.-Dec., 1917 - - -	100	16
Dec., 1917-April, 1918 -	100	24

The Prognosis in Declared Tetanus.—The pre-war mortality of tetanus was about 83 per cent of acute, and 44 per cent of chronic cases. In Italy, judging by published statistics, it appears to have been a good deal less. In Denmark, the figure was given as 79 per cent (Permin, 199 hospital cases).

In individual cases, several factors have to be considered.

Age and sex are not important.

The incubation period is significant. Permin quotes :—

Incubation period of 10 days or less,	94 cases,	94.7 per cent died
„ „ over 10 days,	57 „	70.2 „ „
„ „ unknown,	48 „	58.3 „ „

• In Sir David Bruce's first series (231 cases) :—

Incubation period of 10 days or less,	66.6 per cent died
„ „ 11th to 25th day	39 „ „

When there is no history of a wound, or a very remote one, the majority get well.

Survival Period.—Hippocrates pointed out, and my experience in a series of 28 cases at the Bristol Royal Infirmary confirms his statement, that if the patient survives the fifth day the chances are slightly in favour of recovery. After ten days the probabilities are great.

Second Attacks.—French authorities quote four or five instances of these. Some die; some recover.

Severity of the Symptoms.—It is most difficult to judge of the prognosis from these, unless the case is abnormally slight or abnormally severe. Frequent or powerful spasms, indicating involvement of the cerebrum, as well as the spinal cord and mid-brain (which are responsible for the tonic condition), are almost a death warrant. High fever is a bad sign. There is sometimes a delusive temporary improvement on the third day, followed by death.

In the cases that will recover, there are usually few and slight spasms, or none at all.

Bruce shows that when trismus is the earliest symptom and there is complete closure of the jaws within twenty-four hours, 59 per cent die; when complete closure comes on after twenty-four hours, 26 per cent die; with incomplete closure, the mortality is 23 per cent. When trismus comes on after other symptoms, 19 per cent are fatal; when it does not develop at all, only 16 per cent.

Recovery is slow; the patient may be stiff for a month or more, the masseters relaxing last.

There is a type of *local tetanus*, lately recognized, especially by French writers (Courtellemont, Montais, and Broca), Napier Burnett and Tulloch, and Ritson, in which, after a wound of a limb, there is persistent spasm and rigidity, with exaggerated reflexes,

even under an anæsthetic. This may last many months, but is seldom fatal. A similar condition is met with after injecting tetanus toxin in small animals.

According to French war experience, the Rose cephalic type, associated with facial palsy, is rather favourable.

Prognosis as Influenced by Treatment.—Patients who have had antitetanic serum as a preventive do better than those who have not. In Sir David Bruce's first series of 231 cases in English base hospitals, August, 1914, to August, 1915, 57·7 per cent died. Only 37 had had antitoxin, and only 8 on the day of the wound ; of these 37, 51·3 per cent died. In his third series, August to October, 1916, 200 cases, the results were better :—

1st series: of 231 cases	57·7 per cent died ;	of 37 who received serum	51·3 per cent died
3rd „ : „ 200 „	36·5 „ „ ; „ 102 „ „ „	27·3 „ „	„ „
	„ 87 „ were doubtful	44·8 „ „	„ „
	„ 11 „ had no serum	54·5 „ „	„ „

It must be remembered, however, that these figures may have been vitiated by the time factor. If cases were kept longer in France, as is very possible, the later series would represent patients with a longer incubation period, and therefore a milder type. This would not explain the difference in mortality between the inoculated and non-inoculated. A series of 160 cases from base hospitals in France showed a mortality of 72·7 per cent (Leishman and Smallman). It is not very conclusively proved, therefore, that prophylactic antitoxin makes for a milder attack, although this is probable.

It seems clear, however, that repeated injections have a marked protective value. Bruce gives the following table :—

No. of Inoculations	No. of cases	Recovered	Died	Mortality per cent
Received 1 -	125	94	31	20
„ 2 -	127	103	24	19
„ 3 -	52	43	9	19
„ 4 -	38	35	3	8
„ 5 -	14	13	1	7
„ 6 -	2	2	0	0

Curative Value of the Antitoxin after the Symptoms have Appeared.—This is still in some doubt. Many observations have been made to find the best method of administration. Both in experimental animals and in man the value of the serum is much less after the onset of symptoms than as a prophylactic, because the tetanus toxin is already bound to the nerve-cells.

A table of reliable statistics collected by Permin from the records of Danish hospitals shows :—

Treated without antitoxin,	199 cases ;	79 per cent died
„ with „	189 „ ;	58 „ „

Route of Injection.—Park and Nicoll injected twice the fatal dose of tetanus toxin into guinea-pigs, and seventeen to twenty-four hours later gave an antitoxin by various routes, with the following results :—

6 guinea-pigs were treated subcutaneously,	6 died
15 „ „ „ intracardially,	13 „
16 „ „ „ intraspinally	3 „

There is some human evidence that the intraspinal route is the best, as shown in the table on the next page. Sir David Bruce's careful statistics are specially trustworthy. The usual dose is 3000 units, and it may well be repeated, under an anæsthetic, supplemented by injections of serum subcutaneously.

Sir David Bruce's third series, however, does not show any advantage for the intraspinal over the other routes, so the point cannot be regarded as settled.

Intracerebral injection is dangerous, and has led to abscess of the brain. Neither it nor the intravenous route presents any advantage. Sir David Bruce could not find any

evidence from his statistics that colossal doses give any better results, but before the war Jacobsen and Pease cured 15 cases out of 20 by this means. Their patients, however, seem to have suffered from a mild type of the disease.

TREATMENT OF TETANUS WITH ANTITOXIN.

Reporter	SUBCUTANEOUS		INTRAVENOUS		INTRASPINAL		INTRACEREBRAL	
	Cases	Mortality per cent	Cases	Mortality per cent	Cases	Mortality per cent	Cases	Mortality per cent
Bruce : 1st series -	116	60.3	24	75	215*	45.2	—	—
Von Graff -	—	—	—	—	—	—	88	80
Hofmann -	13	54.0	—	—	16	12.0	—	—
Rogers -	—	—	7	43	—	—	—	—
Ashhurst -	—	—	23	56	—	—	—	—

* Some of these had intravenous or subcutaneous injection also.

During the later stages of the war, the Tetanus Committee recommended intrathecal injections to be given as early as possible in a declared case ; some should also be given by the intravenous route. Large doses (24,000 units) are to be administered if possible. Certainly the extraordinary reduction in the case-mortality, from 80 per cent before the war to less than 20 per cent since the middle of 1917, is a good advertisement for the treatment employed, even if the improvement may have been due to many causes working together (absence of early short-incubation cases, wound excision, prophylactic injections of antitoxin, as well as serum therapy after development of symptoms).

The Carbolic-acid Method has been severely hit by war experience. Baccelli, its author, quoted 92 out of 94 'severe' cases recovering, and 16 out of 38 'very severe.' Apparently no mild cases were treated ! The figures were obtained by a most misleading method—picking out from the literature isolated reportings of one or two cases treated by a host of Italian doctors. Tetanus also seems to be comparatively mild in Italy. Sir David Bruce quotes 33 war cases ; 63.6 per cent died.

Magnesium Sulphate Injections into the Spinal Theca are also falling into disrepute, because several cases of fatal respiratory failure have occurred. Sir David Bruce reports 9 cases, with 7 deaths. Phillips had 7 cases, with 3 deaths.

Rest, quiet, and sedatives, especially chloretone, appear to make the patient more comfortable, and probably improve the prognosis. It would seem to be dangerous to attack the wound during the presence of symptoms ; theoretically, this might cause more toxin to be absorbed.

REFERENCES.—McConkey, *Brit. Med. Jour.* 1914, ii, 609 ; McConkey, *Ibid.* 1915, ii, 849 ; Bruce, *Ibid.* 593 ; Bruce, *Ibid.* 1917, i, 888 ; Wolf, *Münch. med. Woch.* 1915, No. 39 ; Browning, *Brit. Jour. Surg.* 1916, July, 14 ; Permin, *Mitteil. a. d. Grenzgeb. d. Med. u. Chir.* 1914, xxvii, 1 ; *La Pratique de la Chirurgie de Guerre*, 1916, 51 ; Burnett and Tulloch, *Brit. Jour. Surg.* 1916, July, 43 ; Ritson, *Ibid.* 49 ; Park and Nicoll, *Jour. Amer. Med. Assoc.* 1914, July 18 ; Hofmann, *Beit. z. klin. Chir.* 1907, lv, 697 ; Ashhurst, *Amer. Jour. Med. Sci.* 1913, cxlvi, 77 ; Baccelli, *Berl. klin. Woch.* 1911, xlviii, 1021 ; Phillips, *Proc. Roy. Soc. Med. (Med. Sect.)*, 1910, ii, 39 ; Bruce, *Lancet*, 1919, i, 331 ; *War Medicine*, 1918, 724.

A. Rendle Short.

THORACIC DUCT, WOUNDS OF.—Very alarmist reports have been given in the past as to the probable fatal consequences of this accident. In actual practice, however, it is certain that no serious harm need be anticipated. Apparently the chyle finds its way into the veins by some alternative channel. Zesas has collected the records of 49 cases from the literature, of which 5 died ; but only in one of these, and that doubtfully, had the accident anything to do with the fatal issue. Gauze plugging sufficed to cure most ; some required ligature.

In a case recently reported by Mr. Harrison, of Hull, the duct was implanted in the external jugular vein with success. He gives some account of the literature.

REFERENCES.—Zesas, *Deut. Zeits. f. Chir.* 1912, 197 ; Harrison, *Brit. Jour. Surg.* 1916, iv, 304.

A. Rendle Short.

THRUSH.—(See STOMATITIS.)

TIC DOULOUREUX.—(See NEURALGIA, TRIGEMINAL.)

TONGUE, CANCER OF.—Cancer of the tongue and floor of the mouth is one of the most malignant forms of epithelioma, and although there has been a considerable improvement of late in the results of treatment, the outlook is much graver than in cases of cancer of the lip or breast. Cases still come up too late for treatment. At the Bristol Royal Infirmary, 1915-18, only 24 out of 34 cases were operable. Some of the patients had been given iodides, and valuable time thus wasted. The prognosis may be considered under the following headings:—

1. **Prognosis Apart from Operation.**—It is doubtful if any authentic cases have ever recovered, and it is very unusual for the patient to live more than two years. Not uncommonly the period may be as short a time as six months. Patients are sometimes extraordinarily unobservant, and may appear to notice nothing wrong until within a few months of the end. The average duration of life, in cases not operated on, may be taken as about fourteen months from the first onset of symptoms (Rowntree, average of 90 cases). In 37 cases operated on but recurring, the duration of life was seventeen months; but possibly these were rather slower growths from the outset.

The cause of death is nearly always from lung troubles such as septic pneumonia or abscess (114 cases out of 146 autopsies—Rowntree). A few (9 out of 146) die from hæmorrhage. Secondary growths in the neck are almost constant; in the viscera they are rare. In 147 autopsies Rowntree reports the following metastases: liver in 8 cases; lungs in 7; pleura, kidney, and larynx, 4 each; suprarenal, 3.

The patient's last few months of life are generally very miserable. The foul, ulcerous mass in the mouth, profuse salivation, pain in the tongue and ear, and inability to talk, constitute the principal part of his sufferings. The glands of the neck form a huge adherent mass which occasionally suppurates and fungates, or may press on the air-passages; but it is well known that death from glandular involvement is far less terrible than that from the growth in the tongue. Palliative methods of treatment, such as cutting the lingual nerve, give only a brief and partial respite.

Radium treatment is only moderately successful in tongue cases. Quick reports 148 cases treated by this means in three and a half years at the New York Memorial Hospital. Of these, 43, that is 29 per cent, are described as being free from the disease, from three months to three years after the application. Only four, however, were over two and a half years. The radium was buried in the growth, and the neck was rayed; any obvious lymph-nodes were operated upon. Of the total number, 128 were primary cases, and 20 were recurrences; some of the cases, but not the majority, were operable when first seen. Of 34 early cases without enlarged glands, it is claimed that 29 were free from disease from two months to three years after. Obviously the follow-up is not long enough to be very reliable yet.

2. **The Mortality of Operation.**—It will be obvious that this will vary much according to the type of operation performed, the state of the mouth as regards sepsis, and the stage which the growth has reached.

A considerable body of reliable statistics is now available, from which we may judge of the mortality with accuracy. Some of them are hospital figures, probably the best information obtainable. Others are the results of individual operators, which do not appear to be fabricated in any way, and a few are collected from the literature, which is always unreliable as an indication of mortality, because successes are reported while failures are not. (See Table I.)

Simple Removal of the Tongue, or rather of half the tongue in the great majority, without touching the glands of the neck, appears to have a mortality of about 5 per cent, though Whitehead reports a long series in which he only lost 2.6 per cent. He also gives figures inclusive of all his operations (Syme's method, etc.), with a mortality of 14.3 per cent. Rowntree's figures for the Middlesex Hospital do not distinguish between the many in which the neck was untouched, and the few in which all the glands were cleared. His statistics relate in part to the surgery of many years ago, and for these two reasons the figure, 10.9 per cent, is too high. The Bristol and Massachusetts Hospital patients are but few.

In the cases included in this table, laryngotomy and tracheotomy were not performed.

Removal of Half the Tongue, followed by Clearing the Glands of the Neck.—This, which is now regarded as the best form of treatment in ordinary cases, has a mortality probably of about 15 per cent in cases where the two operations are performed at the same time; when they are separated by an interval, it is perhaps no more than 5 or 10 per cent, as in Butlin's and the Bristol figures. Some of the deaths in Caird's cases appear to refer to Syme's operation. The German and Swiss figures lack details of method, and in the Vienna statistics given by Ehrlich, the neck and tongue were usually cleared at the same time. Butlin records 22 cases with 4 deaths when both were dealt with at once, and 48 cases with only 2 deaths when there was an interval of a few weeks. Sebileau gives the mortality as 5 per cent, which accords well with my own experience.

Table I.—MORTALITY OF OPERATIONS FOR CANCER OF TONGUE.

Reporter and Hospital	Whitehead's operation		Whitehead + glands cleared		Kocher's operation		Syme's operation	
	Cases	Died	Cases	Died	Cases	Died	Cases	Died
		per cent		per cent		per cent		per cent
Rowntree, Middlesex (glands usually left) - - - - -	109	10.9	—	—	32	28.1	—	—
Whitehead (tongue only) - - - - -	116	2.6	—	—	—	—	—	—
Do. (all operations) - - - - -	139	14.3	—	—	—	—	—	—
Massachusetts - - - - -	20	5.0	—	—	29	10.3	9	33.0
Boyd and Unwin - - - - -	—	—	33	24.2	—	—	—	—
Ehrlich, Vienna - - - - -	—	—	49	25.0	—	—	—	—
Ehrlich, German and Swiss literature - - - - -	—	—	306	16.0	—	—	—	—
Caird (all operations) - - - - -	—	—	47	14.8	—	—	—	—
Butlin - - - - -	—	—	197	10.0	—	—	—	—
Do. from literature, 1887 - - - - -	—	—	—	—	—	—	47	27.0
Bristol Royal Infirmary (1908–1921) - - - - -	21	14.0	31	10.0	—	—	—	—
Probable average - - - - -	—	5.0	—	15.0	—	18.0	—	30.0

Removal of the Growth by Diathermy, with Crile's Block-dissection of the Neck.—This procedure, though drastic, is said to give the best end-results.

Kocher's Operation.—Few modern statistics of this method, in which the tongue is removed by the submaxillary route, appear to be available. The Middlesex Hospital figures, in which the operation was reserved for bad cases, show a mortality of 28.1 per cent. At the Massachusetts Hospital, where it was resorted to much more freely in comparison with other methods, only 10 per cent died.

Syme's Operation.—When the jaw has to be divided to remove the cancer, the outlook is necessarily grave. The few available figures suggest a death-rate of 1 in 3 or 1 in 4. According to Sebileau, the death-rate of operations by the transmandibular routes is as high as 40 per cent.

The Prospects of Cure.—We are now in possession of sufficient evidence, from a variety of sources, to be able to judge of the prospect of a lasting cure, and as we have hospital figures as well as those of individual surgeons, we may accept them with some confidence. If recurrence is going to take place in this particular form of cancer, it almost always does so in less than three years.

Taking all cases and all operations together, it will be seen that the percentage of patients cured is probably from 15 to 20. Butlin's extensive figures give a much better result than this, but hospital statistics are less favourable than his.

It makes a great difference to the prognosis whether or no the neck is cleared of glands as a routine, even when no enlarged glands can be felt. Thus Butlin reports: glands left, 29 per cent cured; glands removed, 42 per cent cured. In our Bristol figures, the writer finds: glands left, 7 per cent cured; glands removed, 40 per cent cured. The cases were followed, with one or two exceptions, for three years; one patient died of influenza twenty-two months after operation without recurrence. Several operators fail to get such good success in spite of clearance of the neck. The Vienna figures are very

poor (13 per cent cured) ; Ehrlich's report of German and Swiss literature shows that, of 306 cases, 19 per cent were well three years, and a further 11 per cent still free from recurrence for a shorter period.

Table II.—PROSPECT OF ‘CURE’ AFTER OPERATION FOR CANCER OF THE TONGUE.

Surgeon or Hospital	Operation performed	Cases operated on	Free from recurrence	Time followed
			per cent	years
Butlin - - - -	All operations	175	31·0	3
Do. - - - -	Tongue only removed	41	29·0	3
Do. - - - -	Tongue and glands removed	57	42·0	3
Massachusetts Hospital -	Tongue removed, glands usually left	58	17·2	3
Boyd and Unwin - -	Tongue and glands removed	31	19·3	1
Caird - - - -	Tongue and glands removed	25	16·0	3
Ehrlich, Vienna cases -	Tongue and glands removed	49	13·0	3
Ehrlich, from German and Swiss literature -	Sometimes glands also removed	306	19·0	3
Bristol Royal Infirmary (1908-1918) - - -	All cases	41	11·0 less than 3	3
Do. - - - -	Glands left	14	29·0	3
Do. - - - -	Glands and tongue removed	27	7·0	3
Vallas (1907-13) - -	Cancer of mobile part of tongue	32	40·0	3
Do. - - - -	Floor of mouth involved	37	44·0	3
			8·0	3

We may conclude that about a third of cases operated on by removal both of tongue and neck glands will be cured. This is a much better result than was obtained years ago. When the floor of the mouth is free, the back of the tongue not involved, and no palpable glands in the neck, nearly half the patients can be cured.

Information as to the prospect of cure in special circumstances is not so complete. When it is necessary to split the jaw (Syme's operation), recurrence is very probable. Of 5 Bristol cases and 9 Massachusetts Hospital (14 in all), not one was cured. Statistics of Kocher's operation do not appear to be available.

In almost all the patients mentioned in the table, only half the tongue was removed. Probably slightly better results could be got, at the cost of severe crippling, by a total removal. As Lenthal Cheatle has pointed out, surgeons have not been in the habit of removing the half-tongue deeply enough. The geniohyoglossus should be taken.

When glands are palpable in the neck, the outlook is very grave, but not hopeless ; the Massachusetts records show six cured in spite of this sign. In one of our Bristol cases the glands proved to be tuberculous. Operation for recurrence occasionally gives a cure. Butlin records two living respectively 8 and 13 years, out of eight operations for recurrence in the neck glands.

The Time and Situation of Recurrence.—In modern practice, recurrence in the neck and in the mouth occurs with equal frequency. In older days, such as is represented by

Table III.—SITE OF RECURRENCE.

Surgeon or Hospital	Cases	Recurred in glands only	Recurred in mouth
Rowntree, Middlesex Hospital -	90	33	57
Butlin - - - -	90	45	45
Bristol Royal Infirmary - -	14*	7	6

* One case recurred in the spine.

the Middlesex Hospital figures, which go back for many years, a more restricted removal was attempted and local recurrence was commoner.

Rowntree found that glandular recurrence averaged seven months after operation, and local recurrence six months. In two of our Bristol cases there was freedom from symptoms for nearly three years, one recurring in the tongue and the other in the neck.

The Condition after Operation.—Removal of half the tongue usually makes but little difference, eventually, to the speech. One of our Bristol cases, a schoolmaster, could talk perfectly. Swallowing is also unaffected. It must be admitted that if the geniohyoglossus is removed, speech is more seriously affected. Even after bilateral removal the patient may be quite intelligible, but there is of course marked speech defect in these cases. One can almost always promise that the speech will be interfered with much less by the operation than by the progress of the growth.

If there is no local recurrence, the patient's condition is undoubtedly far less miserable than it would have been apart from the operation, because the glands of the neck do not give rise to the same pain and horrible fœtid mouth condition. Even if the cancer returns in the mouth, there is often six months or more of comfort first.

REFERENCES.—Rowntree, *Arch. Middlesex Hospital*, 1916, vii, 131; Whitehead, *Practitioner*, 1903, lxx, 585; Greenough and others (Massachusetts Hospital figures); *Boston Med. and Surg. Jour.* 1909, clx, 563; Boyd and Unwin, *Practitioner*, 1903, lxx, 626; Ehrlich, *Arch. f. klin. Chir.* 1909, Bd. 88, s. 427; Caird, *Edin. Med. Jour. n.s.*, vi, 1911, 5; Butlin, *The Operative Surgery of Malignant Disease*, London, 1900, 2nd ed., 150; Butlin, *Brit. Med. Jour.* 1909, i, 1; A. Rendle Short, *Brit. Med. Jour.* 1912, i, 877 (an amplified account is here made use of); Sebileau et Vallas, *Presse méd.* 1919, xxvii, 595; Quick, *Ann. of Surg.* 1921, lxxiii, 716.

A. Rendle Short.

TONGUE, PAPILLOMA OF.—This condition very seldom gets well apart from treatment, but an early free removal usually leads to cure. It must be borne in mind, however, that in persons over forty the majority of these cases undergo malignant changes, and what appears to be a simple tumour often returns in a few months or years.

A. Rendle Short.

TONGUE, SARCOMA OF.—There are about fifty cases of this rare disease in the literature, but probably only about thirty are worthy of acceptance. The outlook is not so grave as in sarcoma generally, and is better than that of cancer of the tongue. Of 26 cases followed after removal, 11 were cured (7 over three years) and 13 recurred.

REFERENCE.—Fripp and Jocelyn Swan, *Practitioner*, 1903, lxx, 673.

A. Rendle Short.

TROPICAL FEVERS.—The more important fevers of the tropics are dealt with under their respective names. Those with little or no mortality are the following.

Three-day or Pappataci Fever is of common occurrence in North-West India and around the Mediterranean Sea, but is unattended with mortality unless it happens to complicate some more serious disease.

Dengue Fever (with which may be included the seven-day fever described by Rogers) also has no mortality except rarely in old or feeble subjects, but may leave much debility.

Severe purpura and hyperpyrexia have been reported as fatal complications of dengue in children, while the latter may also be dangerous in adults.

Malta or Undulant Fever is a more serious affection, on account of its long duration and occasional severity. Hughes found its mortality in military hospitals in Malta to be but 2 per cent, although it has been stated to be as high as 9 per cent among the civil population of the island, who are less favourably placed regarding treatment. A malignant type of the disease, with a typhoid-like temperature, dry tongue, and tendency to hyperpyrexia, caused over three-fourths of the mortality within a month or two of the onset, while the remainder occurred in relapses with debility and anæmia.

Joint effusions occur in 40 per cent of cases, but subside during convalescence.

Among the more serious and sometimes fatal complications of Malta fever are pericarditis, endocarditis, lobular and hypostatic pneumonia, watery diarrhoea in malignant cases, meningitis, hyperpyrexia, and multiple chronic spasms.

A gradual decline of the temperature to subnormal, with a clean tongue, usually indicates the termination of the disease. The discovery that the infection is carried by goat's milk has led to the disease being practically eradicated from the military forces at Malta. Serum treatment has not been successful, but recently sensitized vaccines have been reported on favourably.

Leonard Rogers.

TRYPANOSOMIASIS AND SLEEPING SICKNESS.—This is one of the most deadly diseases known, although apparent recoveries have been recorded in patients treated in the early stages ; but when the organisms reach the cerebrospinal membranes in the later stage of sleeping sickness the disease is always fatal within a few months. Fatal terminal complications may be caused by lung diseases or septic infections sometimes due to diplococci and dysentery. In the earlier stages the prognosis varies in the two types of the disease, that due to *T. gambiense*, occurring in the more northern parts of Africa, being less virulent than the type caused by *T. rhodesiense* of more southern Central Africa, which is almost invariably fatal within a few months, while no recovery has yet been reported. The first type, however, often lasts for several years, and a few cases have been recorded in which, under prolonged treatment with arsenical and antimony preparations, the parasite and fever have remained absent and good health been maintained for a number of years, with a fair prospect of the recovery being permanent. Thus Daniels has reported on a series of 29 cases in Europeans, who were treated for long periods, usually several years, mainly by arsenical preparations such as atoxyl. Of the 16 *T. gambiense* infections, 7 died and 9 remained in good health from 5½ to 14 years, so may be regarded as cured. In addition, 6 *T. rhodesiense* cases all died ; but recently the same observer has reported a case of this deadly infection who remains well 3½ years after the disappearance of the parasites from the blood, and who received 500 grains of tartar emetic intravenously in the course of about two years, so even this form is not quite hopeless, and antimony preparations give greater promise of success than arsenical ones.

In Nigeria, Macfie reports the disease to be comparatively mild, so the prognosis appears to become more grave the farther south in Africa the case originates.

In Portugese Congo, Gamble with atoxyl in 41 cases had 19 well after 3½ years, and in the Congo State Maschet and Dubois with atoxyl and tartar emetic in the first stage of 28 cases report 23 remaining well for over a year. From German East Africa Ullrich reports 25 per cent of cures of two or more years' duration with atoxyl, and Raven with the same drug in the Congo in 85 cases had 56 (66 per cent) well for from 12 to 18 months ; 14 had died and 7 relapsed.

With prolonged treatment begun at an early stage of the disease a considerable proportion of cases can therefore be cured.

Leonard Rogers.

TUBERCULOSIS.—(See ARTHRITIS, TUBERCULOUS ; BLADDER, TUBERCULOSIS OF ; BREAST, SIMPLE DISEASES OF ; CÆCUM, TUBERCULOUS ; ENTERITIS, TUBERCULOUS ; EPIDIDYMITIS, TUBERCULOUS ; KIDNEY, TUBERCULOSIS OF ; LYMPHADENITIS, TUBERCULOUS ; LARYNX, TUBERCULOSIS OF ; MENINGITIS, TUBERCULOUS ; PERITONITIS, TUBERCULOUS ; PULMONARY TUBERCULOSIS ; TENOSYNOVITIS.)

TUMOURS.—(See under various Organs.)

TYPHOID FEVER.—There are several factors which influence the prognosis in this disease, and the most important of them are : (1) *The age of the patient* ; (2) *The sex* ; (3) *The character of the attack* ; (4) *The presence of certain symptoms* ; (5) *The occurrence of certain complications* ; and (6) *The treatment*.

1. **Age.**—The following figures, derived from the records of 21,371 patients admitted into the hospitals of the Metropolitan Asylums Board during the years 1871 to 1907, indicate to what extent age is of importance in prognosis in respect of recovery :—

FATALITY ACCORDING TO AGE.

Age	Fatality per cent	Age	Fatality per cent
Under 5	9·6	30 to 34	24·3
5 to 9	7·6	35 to 39	25·5
10 to 14	10·4	40 to 44	27·1
15 to 19	15·7	45 to 49	28·0
20 to 24	18·8	50 to 60	32·4
25 to 29	22·5	and upwards	

From this table it will be seen that the most favourable ages are those between five and ten years, and those under five the next most favourable. Over ten years, the fatality steadily increases from 10·4 to 32·4 per cent as the age rises. One of the reasons for the lower fatality under ten is the infrequency of the serious complications of hæmorrhage and perforation at those ages; from which fact it may be inferred that deep and extensive ulceration of the bowel is not so common in children as in adults.

2. Sex.—The prognosis is, on the whole, slightly more unfavourable in the male than in the female sex. The total fatality of the 21,371 cases quoted above was 16·3 per cent; amongst these, the fatality for males was 16·8 per cent and for females 15·9 per cent.

3. Character of the Attack.—All who have had a wide experience of typhoid fever recognize that the clinical characters of the cases which come under their observation vary considerably from time to time. In some years the disease is more fatal than in others. Thus, at the Eastern Hospital, Homerton, the annual fatality has varied during the course of twenty-one years from 6 to 28 per cent. The variation has been quite irregular. The incidence of complications also varies in much the same way. Doubtless there are several factors which have an influence on the character of the attack. Age has already been mentioned. Besides this, there are the factors of the virulence of the particular typhoid bacilli concerned, and the resisting power of the patients. Possibly, too, the dosage (i.e., the number of the bacilli with which the patient has been infected) is of importance. There are reasons for believing that the larger the dose is, the shorter is the incubation period and the more severe the attack.

4. The Presence of Special Symptoms.—The following symptoms must always be regarded with apprehension: A continuously frequent pulse, 130 to 140 or over, more especially if it is at the same time dicrotic (a dicrotic pulse, provided that the pulse-rate is not too frequent, is not necessarily a bad sign); cutaneous hæmorrhages; cyanosis, which may be due either to a failing heart or to hypostatic congestion; coma or semi-coma, with muttering delirium and subsultus tendinum; frequent action of the bowels, with loose and offensive stools; tympanites; a dry, fissured tongue; involuntary passage of the urine and fæces; a strong presentiment of death.

A continuously high temperature (103° to 104°) is not of necessity unfavourable, unless accompanied by some of the symptoms just mentioned. But if the temperature shows no signs of falling after four weeks of illness, the outlook becomes less bright. A rigor, though an alarming symptom, is, on the whole, not an unfavourable one, unless it is accompanied by symptoms indicative of perforation, of which it may be one of the signs. Rigors occur under a great variety of conditions in typhoid fever. Often they are entirely inexplicable. A rigor during convalescence may be the herald of a relapse.

It has been shown by Harold Scott that the prognosis is aided by a careful study of the serum (Widal) reactions. It is well known that the property of agglutinating the specific bacilli is not usually present, at any rate in any marked degree, during the first few days of the illness. According to Scott, in a case of average severity the reaction is usually quite distinct by the seventh day of the fever. If it occurs as early as the third or fourth day, the case is most likely to run a mild course. On the other hand, if the appearance of the reaction is delayed to beyond the end of the first week, the case is likely to be very severe. In some of the most serious cases the reaction continues to be negative for some three or four weeks after the beginning of the illness.

5. Complications.—The occurrence of almost any complication affects the prognosis unfavourably, even though it may be to a slight degree only, because it prolongs the course of the illness and keeps up the risk of additional complications. But some are much more grave than others. The two worst are perforation and hæmorrhage.

Perforation is by far the most serious complication of typhoid fever, and accounts for a fourth to a third of the total number of fatal cases. It occurred in 3·41 per cent of 8997 cases which were under treatment in the hospitals of the Metropolitan Asylums Board during the ten years 1900 to 1909; but the incidence varied in different years from 2·7 to 5·1 per cent. Unless remedied by operation, perforation is nearly always fatal, for not more than 1 per cent of the cases recover. Usually, death from peritonitis results in three to four days from the perforation, but occasionally the fatal event is due

to collapse, and may occur within a few hours or even minutes. Further consideration of this complication will be given later when the treatment is being discussed.

Occasionally one is able to diagnose *peritonitis* without being certain that it is due to perforation. But the former is as grave a complication as the latter, because it is nearly always due to it, though the symptoms may not be clear.

The symptoms of perforation are: sudden, and often (but by no means always) severe, pain in the abdomen, especially in the right iliac region; pain on palpation of the abdomen; alteration in the condition of the abdomen, usually in the direction of some distention; rigidity of the abdominal wall, especially on the right side; thoracic respiration; an increase in the pulse-rate; a sudden rise or fall of temperature; occasionally vomiting and a rigor; collapse.

Hæmorrhage from the bowel is, next to perforation, the most serious complication. It is considerably more frequent than the graver event, and was observed in 9 per cent of the cases referred to above. In these statistics, only those cases of hæmorrhage are included which were sufficiently severe to call for treatment. Both hæmorrhage and perforation are met with in the most serious cases of typhoid fever; and neither of them can occur except when the bowel has been deeply ulcerated. Hæmorrhage is seldom fatal of itself, at any rate immediately; but a repeated loss of moderate amounts of blood weakens the patient, and so conduces to and hastens a fatal termination. As bleeding in any considerable amount cannot take place unless the bowel is deeply ulcerated, it is not surprising to find that perforation is preceded by hæmorrhage in not a few cases: I have seen it in about one-fifth of the cases of perforation at the Eastern Hospital. Profuse arterial is more serious than profuse venous hæmorrhage. Occasionally hæmorrhage is concealed, that is to say, the blood does not pass per anum. In that case it may be diagnosed by the occurrence of pallor, restlessness, a frequent, feeble pulse, collapse, and sighing respiration. The combination of these symptoms is most serious.

None of the remaining complications of typhoid fever, whether serious or not, are at all frequent; they do not exceed 3 per cent. The most grave are *lobar pneumonia*, *meningitis*, and *nephritis*. These are dangerous to life. *Ulceration of the larynx* is usually met with in severe cases only. If the patient recovers, permanent stenosis of the larynx may remain. *Hæmorrhagic typhoid fever*, in which cutaneous and subcutaneous hæmorrhages and bleeding from various mucous membranes occur, is almost invariably fatal.

A *relapse* is to be expected in about 10 per cent of the cases. Usually it begins within three weeks of the final cessation of the fever. In a few cases, however, I have known a relapse to occur after a longer interval, even six weeks. It is impossible to prognosticate the occurrence of a relapse with any degree of certainty; but J. D. Rolleston states that the diazo-reaction reappears at its commencement, and that the disappearance of the abdominal reflex is also a warning. This reflex vanishes during the acute stage of most cases of typhoid fever, but reappears when the temperature has become normal. The fatality of relapses is about half that of primary attacks; and they are less likely than the latter to be accompanied by complications.

There are a few complications which are prone to show themselves more often during convalescence than during the febrile stage of the disease. Of these the most common are *venous thrombosis* and *acute periostitis and necrosis*. They occurred respectively in 2·3 and 1·2 per cent of the cases referred to. The former may follow an acute phlebitis, which may arise in almost any vein, but is met with most often in one of the veins of the leg. But most frequently thrombosis is due to a combination of a sluggish circulation and an altered condition of the blood. The veins most frequently affected are those of the left thigh and leg, which become swollen. It is usually months, and it may be years, before the limb regains its normal state. Sometimes the œdema is permanent. In this complication there is always some risk of the detachment of a fragment of clot, and therefore of pulmonary embolism or cardiac thrombosis; but fortunately these results are rare.

Acute periostitis, which may result in necrosis of the underlying bone, may arise at any time after the acute stage of typhoid fever. Usually it comes on within the first few weeks, but it has been known to show itself years after an attack. Sometimes a definite sequestrum forms; in others, the necrosed bone crumbles, and these cases are prone to become tedious and to resist treatment. The bones most frequently affected

are some of the long bones, especially of the leg ; but almost any bone in the body may be the seat of the inflammation. Rarely are the bones forming a joint involved, but when they are, the joint may be permanently damaged.

In '*typhoid spine*' there is a periostitis of the vertebræ. This complication is rare. It has been met with in the male more frequently than in the female sex. The course of the disease is prolonged, extending to several months or a year ; recovery is usually complete.

In a few cases an attack of typhoid fever is followed by, or it would be more correct to say becomes merged in, one of *acute dementia* (mania or melancholia). As a rule this condition is connected with a very severe attack of the fever, but I have known it follow quite a slight attack. The prognosis is, on the whole, favourable, and the patient recovers in about a year's time.

Influence of Pregnancy.—I have had under my care 38 women who have been attacked by typhoid fever during pregnancy. Of these, 8 died, a fatality of 21 per cent, about the average rate amongst women of the child-bearing ages. Miscarriages or premature confinements took place in 27 instances ; all the fatal cases occurred amongst these 27. If a pregnant woman is attacked by typhoid fever before the child is viable, miscarriage is very likely to occur ; in fact it did occur in 25 of 30 such cases. If she is attacked after the child is viable, there is a better chance of her going to full term ; though even then the child may be weak and frail. Some of the women left the hospital undelivered. Supposing that each of them was subsequently confined of a healthy child, then, of 38 pregnancies, 8 ended favourably both to mother and infant. But certainly in 28 of the 38 cases the child was either born dead, or died within a few hours of birth. The prognosis, therefore, in the case of the child is bad.

6. Treatment.—Of few, if any, of the acute infectious diseases of this country has more been written concerning treatment than has been written of typhoid fever. Baths (cold and warm), intestinal antiseptics, liberal feeding, semi-starvation, copious water-drinking, serum and vaccines, have all had, and still have, enthusiastic supporters, each of whom proclaims that his is the best treatment, and indeed the only one worthy of consideration. But unless the observer has at his disposal a very large number of cases, extending over a considerable series of years, the conclusions he draws from them are likely to be highly erroneous, on account of the natural variation in the severity of the disease from one year to another.

The most extensive series of cases in which a particular form of treatment was contrasted with another, is that given by F. E. Hare. Of 1828 consecutive cases treated during the years 1882 to 1886 in the Brisbane General Hospital, Queensland, by the '*expectant*' method, 271 died, a fatality of 14·8 per cent. This is about the average rate in most places under this form of treatment. Of 1902 consecutive cases treated in the same hospital during the years 1887 to 1896 with *cold or tepid baths*, 143 died, a fatality of 7·5 per cent. The variation in fatality in the first group was from 13·3 to 17·0 per cent, whereas in the second it was from 1·3 to 11·3 ; that is to say, the highest annual fatality amongst the patients treated with baths was lower than the lowest of those who underwent the '*expectant*' method. These figures are strikingly in favour of the bath treatment. I cannot bring forward so large a series of cases ; but, from my clinical experience, I am persuaded that the bath treatment is better than any other of those which have been given a fairly extended trial ; and that, other things being equal, the prognosis is more favourable in cases which are bathed than in those which are not. But the bathing must be commenced fairly early in the disease.

The evidence as to the value of the specific methods of treatment by *antityphoid serum* and *vaccines*, including Besredka's sensitized vaccines, is still somewhat conflicting, though on the whole it is in their favour. Thus, among 1120 vaccine-treated cases collected by Callison and Walters, there were 71 deaths, a fatality of 6·3 per cent. Petrovitch (Serbia, 1916) has reported 2270 cases, with a fatality of only 2·7 per cent, whereas the fatality of 1020 cases treated by ordinary methods was 12·8 per cent. Other observers record encouraging results. On the other hand, Whittington was disappointed with 230 cases treated with stock vaccines. My own experience with serum, and with stock, autogenous, and sensitized vaccines, injected subcutaneously, is that their action is very uncertain. Now and again a case is met with in which the fever appears to be brought

to an end in a few days, in rare cases, indeed, very abruptly in a few hours; but in most of the cases no beneficial result has been observed.

As regards the *diet* of typhoid patients, there is evidence to show that the more liberal scale introduced again of recent years conduces to a lower fatality and complication rate, and to a more speedy convalescence, than does the exclusive, or almost exclusive, milk diet. Thus, Coleman, of New York, writing in August, 1917, reports the results in 444 patients, half of whom were placed on a liberal and half on a milk diet. The fatality of the former was 8.1 per cent, of the latter 17.6. To obtain the best results, the diet-scale should be carefully planned so that the patient receives the equivalent of 3000 to 4000 calories a day in various food-stuffs, given in proper proportions.

Surgical Treatment.—I am not aware that, in respect of the complications, there is any one treatment that is of more certain value than another, except in the case of perforation and peritonitis. It has been stated above that this complication is extremely fatal, and that not more than 1 per cent of those who fall a victim to it recover. That observation applies to cases which are not treated surgically. There can be no question, now, that the patient's chances of recovery are considerably enhanced if the peritoneal cavity is opened and the ulcer which has perforated is sutured. While the reports of published cases show that hardly any case is hopeless, yet there is one condition which especially makes for success, and that is that the operation shall be performed as soon as possible after the perforation has occurred. A few hours' delay will make all the difference. Therefore the physician must be constantly on the watch for the symptoms of perforation, and must be prepared to call the surgeon to his aid, not only as soon as he is fairly certain that there is perforation, but even when he can go no further than to state that most probably it has taken place. By operating early, the acute general peritonitis that almost invariably follows perforation may be averted. It is true that the surgeon who makes a practice of operating early in perforation will occasionally meet with a case in which no perforation can be found, in which, indeed, no perforation has occurred; there may not even be peritonitis; experience, however, has shown that, in the majority of such cases, little or no harm is done; of 16 such cases reported by Gibbon, of Philadelphia, recovery took place in 10.

Another important factor which influences the prognosis of the operation for perforation is the condition of the patient at the time of operation. Those cases do best in which the patient has begun to convalesce when perforation has taken place; and the outlook is worst in those in whom it occurs during the height of the disease. Still, no case should be looked upon as absolutely hopeless; and the only contra-indication to operation is a moribund state of the patient.

It is difficult to estimate the true recovery-rate after laparotomy for perforation. Published statistics vary from about 8 to 50 per cent, but it is certain that more instances of successful than of unsuccessful cases are reported. G. E. Armstrong, of Montreal, published in 1910 a series of 78 cases of operation, with 24 recoveries, a recovery-rate of 30.7 per cent, an extremely good result. Gibbon has recorded 96 consecutive cases (in all of which perforation was found), with 17 recoveries, that is, 17.7 per cent. Recently (1920) Leotta (Rome) has had 7 recoveries out of 14 perforations. Of 117 consecutive cases operated upon in the hospitals of the Metropolitan Asylums Board during the fourteen years 1901 to 1914, 9 recovered, a recovery-rate of 7.6 per cent. Only perforation cases are included amongst these. During the same period there were 17 cases of laparotomy in which no intestinal perforation was found. In most of the cases there was peritonitis, more or less extensive. Four of the cases recovered. Armstrong's report does not state whether perforation was found in all his cases. The recovery-rate is higher in cases of operation in which no perforation has occurred than in those in which it has occurred. But even the 7.6 rate quoted above is better than the 1 per cent of recovery in cases of perforation which are not submitted to operation.

Antityphoid Inoculation.—The prognosis, both as regards protection from an attack, and recovery when attacked, is well illustrated by the figures which were published in May, 1913, by the Antityphoid Committee appointed by the Army Council in 1904. The committee investigated the histories of 19,314 soldiers, whose period of service abroad, in places where they were likely to be exposed to the infection of the disease, averaged twenty months. Of these soldiers, 10,378 were inoculated, and 8936 were not. The

incidence of typhoid amongst the non-inoculated was 30·4 per mille, while amongst the inoculated it was only 5·39 per mille. In respect of the influence of inoculation on the severity of an attack, the committee investigated the histories of 258 cases of typhoid fever amongst these soldiers. Of these, 202 occurred in soldiers who had not been inoculated, and 56 in those who had been inoculated. The cases were divided into two classes, the mild and the severe (including the fatal). Amongst the inoculated men, 66·1 per cent belonged to the mild class, and 33·9 to the severe; while amongst the non-inoculated, 29·3 per cent belonged to the mild, and 70·7 per cent to the severe.

These figures may be supplemented by those derived from the experience of the recent war. During the winter of 1914 and the spring of 1915, cases of typhoid fever, relatively few in number, appeared amongst the British troops in Flanders. Up to May 22, 1915, there were 827 cases. Of these, 508 occurred amongst the non-inoculated men, and 106 were fatal, a case-mortality of 20·8 per cent; while 319 occurred amongst the inoculated, and 22 were fatal, a mortality of 6·8 per cent. The incidence of attack was fourteen times higher amongst the non-inoculated than amongst the inoculated.

The British conclusions have been confirmed by the experience of antityphoid inoculation on a large scale in the armies of the United States, France, and Germany, especially the first of the three. Since the last quarter of 1911, antityphoid vaccination has been made compulsory for all persons in the military service of the United States under 45 years of age. The practice had been first employed on a small scale in 1909, and was voluntary up to the date just mentioned. Large numbers of men were vaccinated during 1910 and 1911. Before 1910 the number of cases of typhoid per mille of the mean strength varied from 3·1 in 1905 to 6·9 in 1902. In 1910 it was 2·4, in 1911 0·8, and in 1912 0·3, while for 1913 and 1914 it was less than 0·1. It is not certain, however, whether the whole of this improvement is due to inoculation.

E. W. Goodall.

TYPHUS FEVER.—The factors which must chiefly be taken into account in considering the prognosis in this disease are: (1) *The age*; (2) *The sex*; (3) *The habits and physical condition of the patient*; (4) *The occurrence of complications*; (5) *The presence of certain symptoms*; and (6) *Treatment*.

1. **Age.**—The influence of age is well illustrated in the following table compiled by Murchison, which shows the facts in respect of 18,268 cases admitted into the London Fever Hospital during the twenty-three years 1848 to 1870:—

FATALITY ACCORDING TO AGE..

Age	Fatality per cent	Age	Fatality per cent
Under 5	6·69	40 to 44	30·79
5 to 9	3·59	45 to 49	42·54
10 to 14	2·28	50 to 54	49·62
15 to 19	4·46	55 to 59	53·96
20 to 24	10·33	60 to 64	60·25
25 to 29	15·17	65 to 69	75·53
30 to 34	20·55	70 to 74	72·62
35 to 39	25·92	75 & over	85·71

The fatality for all ages was 18·92 per cent.

From this table it appears that the fatality is moderate below twenty years of age, and is indeed low in the age-group ten to fourteen. There is a very considerable increase in the fatality after nineteen years of age, and a constant rise for every decennium after that. The disease is extremely fatal after the fiftieth year.

Murchison's figures were based on admissions to the London Fever Hospital, in days when typhus was not a notifiable disease. Experience has shown that the cases of infectious diseases treated in hospitals contain an undue proportion of severe cases. Murchison himself was of the opinion that the fatality of all cases of typhus probably did not exceed 10 per cent. The experience derived during the past years from the epidemics in Poland where the disease has been compulsorily notifiable, goes to show that the

case-mortality for all ages varies from time to time and in different epidemics and in different places. In the Polish epidemics it varied from 5 to 13 per cent. Commonly it was 10 or 11. The figures relating to 5747 consecutive cases notified at Warsaw at the end of the year 1917, during the severe epidemic in that city, show case-mortalities at different age-groups as follows :—

Under 10	-	0·7 per cent	40 to 49	-	16·7 per cent
10 to 19	-	1·2 „	50 to 59	-	52·6 „
20 to 29	-	4·1 „	60 and over	-	40·0 „
30 to 39	-	10·1 „			

From these figures it appears that the younger the patient the more favourable is the prognosis ; and that the prognosis is good in patients under 30 years of age.

2. **Sex.**—Murchison's figures go to show that on the whole the disease is slightly more fatal in males than in females, the fatality being 19·67 per cent for the one sex and 18·92 per cent for the other. The difference is most marked at ages over forty-five. In children from five to fourteen the fatality is rather higher in females than males.

3. **Habits and Physical Condition of the Patient.**—The prognosis is unfavourable in very fat and in big, muscular persons, in those of intemperate habits, and in those who are the subjects of chronic diseases, especially of the kidneys.

The influence of pregnancy is shown by the following figures. Of 107 pregnant women who came under Murchison's care at the London Fever Hospital, 49, or 45·8 per cent, aborted about the tenth to fourteenth day of the disease ; 9 of those who aborted died, but the remaining 98 all survived. From these figures it appears that if a pregnant woman is attacked by typhus, she is very likely to abort ; and that if she does so, the prognosis in her case becomes worse.

4. **Complications.**—Murchison stated that, in his experience, death in patients under fifteen years of age was almost always due to some severe complication. Fortunately, however, complications are not very common in this disease.

Those most frequently met with are *bronchitis* and *hypostatic congestion of the lungs*, and the occurrence of the latter augments the gravity of the prognosis. *Laryngeal inflammation and ulceration* is a rare but very dangerous complication. *Suppurating buboes* of the neck (due to inflammation of the parotid and submaxillary glands and the surrounding tissue) are relatively common, and usually add to the severity of the attack.

5. **Special Symptoms.**—The following are unfavourable symptoms : an abundant rash with a large proportion of petechiæ ; cutaneous hæmorrhages ; hypostatic staining of the skin ; cyanosis ; hurried respiration ; profuse perspiration at the crisis ; a pulse-rate persistently over 120, especially in adults ; pronounced nervous symptoms, viz., sleeplessness for three or four days, delirium (especially violent), convulsions, coma, coma-vigil, muscular twitchings, hiccough, contraction of pupils to a pin-point ; extreme prostration ; a notable diminution in the amount of urine ; a presentiment of death. The earlier severe cerebral symptoms appear, the worse the prognosis. It is a favourable sign if at the end of the first week the temperature drops a little, and still more so if it does not rise again before the crisis. On the other hand, it is very unfavourable if the temperature keeps steadily high, and especially if it rises and keeps up during the second week. An abrupt rise to 105° or more, just before the crisis is expected, is of very grave omen. Relapses are very rare.

E. W. Goodall.

ULCERATIVE ENDOCARDITIS.—(See ENDOCARDITIS, ULCERATIVE.)

URÆMIA.—The prognosis in uræmia must always be guarded ; as a general rule, it is very grave. Will the patient survive the immediate attack, and if so, will the condition recur ?

In acute nephritis, when the patient exhibits all the phenomena of an acute inflammatory affection of the kidneys, with partial or total suppression of urine, death may result from an initial convulsion ; but if appropriate measures have been effective in controlling the convulsions, and if there be favourable response to further treatment, no more uræmic phenomena may develop, and the ultimate prognosis becomes that of an attack of acute nephritis, and may be entirely favourable.

In chronic nephritis, whether diffused or interstitial, the outlook is very serious. In the convulsive form, death may occur early from failure of heart and respiration during a convulsion, or the patient may die comatose after repeated convulsions. Even if temporary improvement takes place under treatment, recurrence of uræmia in some form is almost certain; and the prognosis is very grave, the fatal issue being, as a rule, only a question of weeks. When, in the uræmia of chronic nephritis, the onset of the nervous phenomena is gradual but progressive, the prognosis is immediately very unfavourable. The patient is, at first, merely dull and apathetic, possibly very irritable when roused; the kidney function is very deficient, and nitrogen retention is present. In a few days, apathy becomes more marked; the patient is difficult to rouse, and passes into coma; and a series of convulsions may precipitate the fatal issue.

Chronic uræmia, giving rise to alimentary symptoms, also justifies a very grave prognosis. The chronic nephritic who develops a dry, furred, cracked tongue, persistent vomiting, and possibly diarrhœa, is in a critical condition. In the dyspnœic form of uræmia, a fatal issue is probable; for even if there be favourable response to treatment, the kidney inadequacy is marked, and recurrence of uræmic symptoms is almost certain. Other phenomena of chronic uræmia, such as persistent headache, amaurosis, giddiness, paralytic phenomena, and marked insomnia, are all grave symptoms which point to pronounced deficiency of renal function.

Francis D. Boyd.

URETERAL CALCULUS.—(See KIDNEY AND URETER, CALCULUS OF.)

URETHRA, RUPTURED.—*The immediate mortality* of ruptured urethra depends upon two factors: whether extravasation of urine has taken place, and whether there are other grave injuries, such as fractured pelvis. Apart from these, there is no great danger at the time.

In 205 literature cases, uncomplicated by other injuries, Kaufmann gives the mortality as 14 per cent, but only 91 of these had an operation within two days; of these latter, 9 per cent died. The deaths were mostly due to extravasation; when this had occurred, 36 per cent were fatal.

Martens records 17 patients, 4 of whom had fractured pelvis, who were operated on at once, and only 1 died. This would be more in accord with modern practice.

The late result is an intractable stricture. In the older surgery this was almost inevitable, but early operation does much to ward off the danger. Rutherford reports 7 cases treated promptly by perineal section and suturing; 5 remained free from stricture for years, but 2 developed a narrowing. Cabot followed 5 operation cases for five years, no stricture following.

REFERENCE.—Thomson Walker, "Ruptured Urethra", *Burghard's System of Operative Surgery*.
A. Rendle Short.

URETHRAL STRICTURE.—One of the axioms of the older surgery was, "Once a stricture, always a stricture," and it has even been suggested by a famous surgeon that maxims of this sort should be framed and hung up to adorn the walls of hospital wards instead of the texts which used to be customary! To-day, the axiom is not quite true.

Urethral stricture may come on at any time after an injury. It follows gonorrhœa at one of two periods, the first about two to four years after the attack, and the second between ten and sixteen years after. A certain amount of narrowing may be detected as early as six months after the infection, giving rise not to obstruction but to gleet. Traumatic strictures are usually worse than those due to gonorrhœa.

The dangers to which stricture may give rise depend entirely upon the willingness or unwillingness of the patient to allow proper treatment. Granted a willing patient, stricture need never cause any severe symptoms, except in old, neglected cases of long standing, and in a few of the worst of the traumatic strictures. In a careless or timid patient, of course, a long string of troubles may follow—attacks of retention, peri-urethral abscess, perineal fistula, cystitis, epididymitis, extravasation of urine, rupture of bladder, and septic pyelonephritis. Any of the last three may end fatally. A patient with stricture is in danger of his life when the urine is very foul, when rigors and fever follow attempts at instrumentation, or when the bladder remains full for days. Too rapid emptying, in such a case, will often lead to death from suppression. Other signs of

renal infection are polyuria, a fall in the urea output, wasting, sweating, thirst, and urinous odour of the breath.

Rupture of the bladder is a rare event in acute retention; more commonly the membranous urethra gives way, leading to extravasation of urine. Many cases of this disease are really a spreading cellulitis rather than a true extravasation.

The Effect of Treatment.—*Intermittent, one-stage, or continuous dilatation*, the routine treatment, is safe, except in patients whose kidneys are seriously involved, but it seldom, if ever, cures the stricture, and must be repeated at intervals of one to three months. Sometimes, however, it takes years for a well-dilated stricture to contract down sufficiently to trouble the patient much.

Internal urethrotomy is used by some surgeons where others would dilate. The mortality is about 1 per cent; of 1018 cases treated at St. Peter's Hospital, 0·78 per cent died, and of 4686 cases collected from the published records of various surgeons, 1·1 per cent died. In the great majority of cases well followed through, a subsequent dilatation will be found necessary at intervals of three to six months, but in rare cases it cures outright. On the other hand, a few patients need to have the operation repeated.

External urethrotomy seldom cures; it is now usually reserved for the worst impassable strictures, and subsequent regular dilatation will be required. Sometimes the operation has to be repeated. The mortality in 100 cases at St. Peter's Hospital was 8 per cent (1895 to 1908), and older figures agree well with this.

Excision of the stricture is sometimes a perfect cure, but the results are not always very satisfactory in the bad cases on which it is usually tried. Its success greatly depends on whether the urine is clean or foul. Many cases of permanent cure are, however, quoted by Thomson Walker from the literature.

REFERENCE.—Thomson Walker, "Stricture," *Burghard's System of Operative Surgery*.

A. Rendle Short.

UTERUS, CANCER OF.—Two distinct clinical conditions require consideration under this head: (I) *Carcinoma of the cervix*, in which the results of operative treatment are by no means favourable, and (II) *Carcinoma of the body*—a comparatively rare disease—where, on the other hand, the results may be said to be good.

I.—CANCER OF THE CERVIX.

It is necessary to consider the outlook both from the clinical side and also in relation to treatment. The prognosis of a case of cancer of the cervix depends essentially upon whether or no the disease is eradicable by operation; so the first consideration is to determine whether the case is operable or inoperable; for at the present time the only sure means at our disposal for curing the disease is the extended abdominal hysterectomy (Wertheim's operation). It is quite true that claims have been made on behalf of radium as a curative agent, and that successful cases have been reported; but the evidence is not convincing, whatever the future may bring (and it may bring much).

Prognosis in Relation to Clinical Conditions.—In the majority of cases the decision as to operability is easy on examination: the case is either obviously operable or is just as obviously inoperable. The difficulty lies in borderline cases; sometimes the decision becomes clear when the patient is examined under anaesthesia; in other cases the surgeon is only able to make up his mind after he has opened the abdomen and explored the pelvis; in other cases still, an operation has to be abandoned after it has been begun, owing, for example, to the impossibility of dealing with unexpectedly extensive involvement of the bladder. But it is a good plan to operate in all cases of doubtful operability; cases which on clinical examination seem unpromising are often proved operable by the operation being successful and the patient remaining free from recurrence for many years; for example, cases are recorded in which the ureter has had to be dug out of a mass of cancerous tissue, or a piece of cancerous bladder wall has had to be removed, and yet the patient has been cured. The operation, in these doubtful cases, should be regarded as a life-saving one. The *operability-rate* (or *operable ratio*) varies, and will be referred to later.

The following points present themselves for consideration in any particular case: (1) The size of the growth; (2) Its extension; (3) The glandular enlargement; (4) The condition of the growth; (5) The general state of the patient.

1. *The size of the growth* is not *per se* a very good criterion as to operability; thus

a comparatively large vaginal growth which is freely movable is sometimes seen, and merely indicates a slow-growing type—more especially in elderly patients; while a comparatively small cervical growth may yet be fixed. It is in relation to the degree of fixation that the size becomes important.

2. *Extension of the growth* superficially along the vaginal surfaces is fortunately not common, but when present it usually indicates some involvement of the wall of the bladder or rectum, so that such cases are no longer suitable for radical operation. Unfortunately, too, *x* rays and radium, when applied to these cases, frequently give rise to fistulous openings.

As regards thickening, or apparent extension into the pelvic tissues in any direction, one must be careful to recognize that early fixation is an inflammatory process of a chronic nature, representing septic absorption from the growth, and practically always preceding an extension of a growth. Clinically there is nothing more difficult than to decide whether the fixation present, be it to bladder, rectum, or pelvic wall, is inflammatory or malignant. In many cases the doubt will only be solved by an exploratory laparotomy with attempted removal of the uterus.

Thickening in the broad ligament, if well marked and extending right out to the pelvic wall, is likely at any rate to contain malignant cells in the portion adjacent to the ureter, and therefore more reliance is to be placed upon consolidation of the base of the broad ligaments. However, even in these cases the ureter may escape invasion, and be dissected out from a mass of growth during operation. It is probable that the rhythmic waves of contraction serve to protect it against invasion. The prognosis in such cases is not good, but life may be prolonged and made more comfortable by operative measures. Farrar Cobb¹ records a case in which the ureter was dug out, and the patient was alive and free from recurrence thirteen years later.

3. *The glandular enlargement* is only occasionally to be detected on examination. As a rule it is only noted during operation, and then as more commonly affecting the iliac and obturator group of glands. The enlargement of the lymph glands must not be taken as in all cases indicating malignant metastasis. Thus, some enlargement of the lymph glands is present in 90 per cent of cases, but evidence of malignancy, even after microscopical examination, only occurs in 15 to 20 per cent of cases operated upon.

4. *The condition of the growth* will often explain the cachexia. Foul, ulcerating growths, both by reason of the associated hæmorrhage and the septic absorption, lower the resistance of the patient, so that the shock of an extended operation may prove too severe, or during convalescence a cystitis or pyelitis may determine a fatal issue.

Another serious risk is that during operation the peritoneum or operation area may become infected from the septic cervical growth, and so cause an acute peritonitis or a deep pelvic abscess. Probably at least 20 per cent of all deaths are to be attributed to this cause.

5. *The general condition of the patient* is often too readily dismissed with a cursory examination. Thus, until recently it was customary to regard a cachectic state as an indication of advanced growth, while another patient, fat and healthy looking, was considered as being probably in a less advanced condition. But this is by no means generally true; for the post-mortem records of cancer institutions show that not more than 50 per cent of the cases of cancer of the cervix die in a cachectic state, while the remainder are well covered, and in many cases even fat. Now in many of these latter cases the cause of death has been an ascending pyelitis supervening on a hydronephrosis and dilated ureter or ureters, the result of lateral extension of the growth. It is evident that cachexia is merely an accident of the disease, depending upon septic infection of the growth. Consequently, in judging of the risk of operation and the chances of complete cure, a careful examination is required which shall include investigation as to the cardiac condition, the degree of anæmia, and, above all, the renal sufficiency.

Further, it is to be remembered that a certain degree of fatness increases considerably the difficulty of complete extirpation and in consequence the risk of injury to the bladder or rectum, and also renders difficult the immediate arrest of hæmorrhage during the surgical procedure.

Nevertheless, it yet remains true, that in cases showing well-marked cachexia, with septic conditions of the growths, the prognosis is not good.

Prognosis after the Radical Operation.—The operative treatment of cancer of the cervix has improved immensely during the last generation, with two results: a larger percentage of cases are operable, and a larger percentage of those operated on are cured. Amputation of the cervix and vaginal hysterectomy (except for the extended vaginal hysterectomy of Schauta, which sometimes has to be employed in excessively fat patients) have been relegated to surgical limbo. The operation that is now performed is the extended abdominal hysterectomy, established by Wertheim and known by his name throughout the civilized world. This severe operation consists in the removal, together with the uterus, of a wide cuff of vagina, of the pelvic (especially the paracervical and paravaginal) cellular tissue, and of the pelvic lymphatic glands. In consequence of this wide removal of tissue many more cases are operable than formerly, and the percentage of cures after operation has been raised. The *operability-rate* (or *operable ratio*) varies from 40 to 60 per cent as shown by published statistics; the differences depend largely on the stage of the disease at which patients present themselves for treatment (in private practice, where patients take more notice of early symptoms, it is higher than in hospital practice), but are also considerably influenced by the indications and limitations accepted by different operators. Owing to the better education of the medical and lay public in the matter, the operability-rate has of late years shown a tendency to increase, the diagnosis being made earlier and a larger number of cases being sent promptly for operation.

The results of the operation vary within certain limits according to the selection of cases, the extensive nature of the operation, and the skill of the operator. Speaking generally it may be said that a careful selection of cases will show a high percentage of cures amongst those operated on, and a low immediate mortality, whilst the percentage of cures will be lower, and the immediate mortality will be higher, if the operator selects his cases more widely and includes advanced as well as early cases. The *immediate mortality* to be expected from the operation, as performed by expert operators, is about 10 per cent.

A conventional standard of five years' freedom from recurrence after operation has been generally adopted for estimating the results of the operation as regards cure of the disease; if a patient has remained free from recurrence for five years she is said to be 'cured'; the number of cases recurring later is extremely small. Recent statistics show that the percentage of patients remaining free from recurrence at the end of five years is from 40 to 50 per cent. When there is recurrence, it usually happens in the first year following operation; afterwards, recurrence becomes less common with each succeeding year.

The *total curability* of cancer of the cervix is reckoned by comparing the number of patients remaining free from recurrence at the end of five years after operation *with the total number of patients applying for treatment*: the ratio between the two gives the total curability. The difference between the *total curability* and the more restricted *operative curability* must be clearly distinguished for statistical purposes. Recent statistics show that the total curability has increased twofold during the last twenty years, and with earlier diagnosis it may eventually be hoped to reach 25 per cent. Wertheim's² statistics (published in 1913) deal with 979 patients originally applying for treatment five years or more previously; 450 were operated on, an operability-rate of 46 per cent; the primary mortality was 19·5 per cent (30 per cent in the earlier and 9 per cent in the later operations); 186 patients remained free from recurrence after five years, giving an absolute curability of 19 per cent, and a percentage of cures amongst those operated on of 41 per cent. Berkeley and Bonney have published three-year statistics dealing with 71 operations amongst 112 patients applying for treatment, an operability-rate of 63 per cent; the immediate mortality was 22·5 per cent, and 55 per cent of those recovering from operation remained free from recurrence at the end of three years, giving an absolute three-year curability-rate of 26 per cent.

Palliative Treatment (including radium, α rays, and the Percy cold cautery).—*Radium* in no sense competes with the radical operation in operable cases: radium is a palliative method of treatment, and the special indications for its employment are inoperable cases and cases of recurrence after operation. Experience has shown that recurrences after operation are not so likely to be benefited by radium as are primary growths. Radium may also be used as a preliminary to operation in inoperable or borderline cases, and often succeeds in rendering such cases operable; such treatment is supposed to affect some of the cancer-cells beyond the operative area. In inoperable or recurrent cases radium may

be expected to relieve the local manifestations of the disease—fungating growth, ulceration, hæmorrhage, discharge, and pain—in a striking fashion. In favourable cases growth and dissemination are retarded. Bumm³ well illustrates the effects of irradiation. He has obtained the uterus in five cases at varying periods after treatment. In each case some focus of disease remained, although in two of them it was only microscopically detectable. In the majority of cases the results depend upon the type of growth—that is to say, with a superficial papillomatous mass an excellent result will be obtained, simulating, if not actually producing, a cure; while in penetrating growths the external appearance of the cervix and the relief of symptoms will suggest a cure, but the growth proceeds in the depth and in the lymph tracts. The best results will be obtained where the cervix is curetted before applying the radium, so as to get greater and more widespread radiant effect.

A disadvantage of the treatment, as acknowledged by Degrais and Bellot,⁴ is that there is a tendency to the production of fistulæ when the growth has already invaded the wall of the bladder or rectum.

Clark⁵ reports a series of 209 cases: 73 are living, one after five years, some after four years, 11 after three years, 23 after two years, and 34 after one year.

A series of cases treated by the *cold cautery method* of Percy has recently been reported by Cole.⁶ The method is well worth a trial in inoperable cases, though it is not yet established that it is superior to radium. The primary mortality in Cole's series of 43 cases was 10 per cent. 7 of the patients acquired vesico-vaginal fistulæ; in 17 patients the average duration of life subsequent to the operation was sixteen months; as all the cases were of a very advanced type, and bearing in mind that the average duration of all cases of cancer of the cervix is about twenty-one months, it is apparent that in these 17 cases there was a distinct prolongation of life: there is no doubt that the distressing local symptoms and cachexia are remarkably relieved by this method.

The use of the *hot cautery* is often most beneficial in its effect, especially with the slow-growing superficial tumours. It helps to clear the growth, and formerly it was much more extensively employed. Wherever possible, however, radium is preferable.

Ligation of the internal iliac and ovarian arteries for the continuous hæmorrhage has in many instances caused relief from the bleeding, and the diminished blood-supply has seemed occasionally to retard the growth.

Prognosis apart from Treatment.—Two classes of case come under this heading: (1) Early cases, in which the radical operation is refused by the patient: such cases are, naturally, extremely rare; (2) Cases first seen by the surgeon in the inoperable stage. The extent to which the latter class of case may be influenced by palliative treatment has been already referred to. The prognosis, apart from treatment, is concerned with how long the patient is likely to live, and what is likely to be her mode of death. It is difficult to estimate the duration of cancer of the cervix from start to finish, because there are no recognizable symptoms until the disease has reached a more or less advanced stage. From the beginning of obvious symptoms, the duration seems to vary from four to six months to four or five years (Wilson⁷); Leitch⁸ found the average duration in 900 cases to be one year and nine months. Very exceptionally, cases last a much longer time; for example, Wilson mentions the cases of two patients who lived for seven and eight years respectively after the first discovery of the disease. As regards the mode of death, in many cases the patient dies from gradual exhaustion, worn out by the continued bleeding, discharges, and pain. In a large proportion of cases, probably the majority, uræmia is the direct cause of death, due to involvement of the ureters in the growth; uræmic convulsions and total suppression of urine are not rare. In some cases death is precipitated by the result of a bacterial infection such as pneumonia, bronchitis, pleurisy, peritonitis, or septicæmia. In the majority of cases death only releases the patient after suffering for months from severe pain and the added discomforts of bladder and rectal fistulæ.

Cancer of the Cervix and Pregnancy.—The frequency of pregnancy in cancer of the cervix has been estimated at about 5 per cent. Pregnancy has a baneful effect; the cancerous growth shares in the general increased vascularity of the uterus, and grows and spreads more rapidly. Abortion is common. The local effects produced by labour at or near term are very serious; the growth is crushed and torn, and the tear usually spreads into the cervix, body, or connective tissues; spread of the growth is hastened, and

sloughing and sepsis are almost sure to occur. Herman⁹ collected 180 cases with 72 deaths of mothers, 11 from rupture of the uterus.

II.—CANCER OF THE BODY OF THE UTERUS.

This is a comparatively rare disease, but the end-results are very much superior to those of malignant disease of the cervix. The frequency of the disease may be gauged from the fact that in 248 cases of uterine growth recorded by Mayer, only 37, or 14.9 per cent, were localized in the body.

Prognosis from the Clinical Aspect.—As a rule there is little in this respect upon which to base an opinion as to the outlook. In the first place, the diagnosis is frequently obscured by the presence of fibromyomata, to which are accredited the symptoms of the disease; in the next place, the symptoms and the knowledge to be gained by bimanual examination together do not furnish sufficient information for the recognition of growth in the majority of cases.

Certain features may be taken as indicating advanced growth, and therefore limiting the chances of eradication. The size of the uterus, in the absence of myomata, is a distinct index of the extent and amount of the neoplasm. Again, a mass outside the uterus may indicate a metastatic nodule affecting the appendages or pelvic structures—but it is not to be invariably taken as of serious import; because, in perhaps the majority of cases where such a mass exists, it is of inflammatory nature, and results from extension of the septic infection from the uterine growth.

Another clinical feature of some importance is the character of the discharge. Excessive bleeding, through the resulting anæmia, obviously detracts from the safety of undertaking operation. A foul discharge is still more important, both on account of the septic absorption which goes on, and from the risk of spreading the infection during operation. Infection of the peritoneum, and of the operative field generally, probably accounts for the greater part of the operative mortality.

Prognosis in Relation to Treatment.—The results of treatment are those of total hysterectomy—no other measure is to be recommended. The abdominal operation is now far preferable to the vaginal. It frequently happens that a small growth affecting the body is discovered by the pathologist during convalescence, and in many such cases a subtotal hysterectomy only has been performed. In such cases it must be decided whether the margin of healthy tissue between the growth and the point of resection is sufficient to justify the risk of leaving the cervix. There are no precise figures obtainable, but from general experience it may be said that such a procedure appears comparatively safe. The presence of large fibroids renders the vaginal operation unsuitable in many cases.

Mayer,¹⁰ before 1906, operated on 26 cases with the following results: 3 (11 per cent) died from operation; 7 (26.9 per cent) showed recurrence; and 13 (52 per cent) alive and well after five years. Five-year statistics have also been published by Winter, who had 16 patients remaining free from recurrence for five years out of a total of 30 operations. Wertheim's primary mortality was 10 per cent, and 51 per cent of his patients remained well after five years. From all of which it will be seen that the results of treatment in cancer of the body of the uterus are relatively good.

REFERENCES.—¹*Boston Med. and Surg. Jour.* 1914, June, 861 et seq.; ²*17th Internat. Congr. Med. London*, 1913; ³*Berl. klin. Woch.* 1914, Feb., 193; ⁴*Canad. Pract. and Rev.* 1914, June, 334; ⁵*Surg. Gynecol. and Obst.* 1918, June; ⁶*Proc. Roy. Soc. Med. (Obst. and Gyn. Sect.)*, 1921, xiv; ⁷*New System of Gyn.* 1917, ii; ⁸*Arch. Middlesex Hosp.* 1916; ⁹*Trans. Obst. Soc. Lond.* 1879, xx, 191; ¹⁰*Monats. f. Geburtsh. u. Gynäkol.* 1911, xxxiii, Heft 6, June.

Eardley Holland.

UTERUS, FIBROIDS (FIBROMYOMATA) OF.—The prognosis is influenced by so many factors, that each case must be considered as regards its peculiar features. The subject may be discussed under two heads: (I) *The prognosis from the clinical point of view*; (II) *The prognosis in relation to treatment*.

I.—PROGNOSIS IN RELATION TO CLINICAL FEATURES.

Many women have small fibroid nodules of the uterus which, being symptomless, are either overlooked or only discovered by accident during the course of an examination, or post mortem. It is estimated that 20 to 30 per cent of women who reach the age of forty years show fibroid tumours in the uterus.

Risks due to the Presence of a Fibroid.—The possessor of a fibroid may be said to incur the following risks in varying degree : (1) Enlargement of the fibroid ; (2) Degenerative changes in the tumour ; (3) Excessive menstrual loss ; (4) Extrusion of the tumour ; (5) Inflammatory changes ; (6) Pressure symptoms ; (7) The possible association of carcinoma ; (8) Abnormal conditions in pregnancy and labour.

The degree in which these risks are incurred is difficult to estimate. Where the patient is approaching the climacteric and the tumour is small, and more particularly if it be subperitoneal in position, the chances of any of these ill-effects are slight. When, however, the patient is relatively young (under forty years of age), the period of time that intervenes before the menopause considerably increases the liability to certain of these risks.

1. *Increase in size* of a tumour is usually slow, but may in certain circumstances be rapid. It will then be difficult to decide whether the increased size is due to mere rapidity of growth or to degeneration.

2. *Degenerative changes* as a rule cause enlargement of the tumour, but except in the case of 'red degeneration' give rise to little anxiety. Thus, almost the only consequences of œdematous, myxomatous, or cystic degeneration are an increase of pressure symptoms.

'Red degeneration' may be a more serious condition which, from the peculiar symptoms (pain and tenderness, and sometimes rise of temperature) and the frequent association with pregnancy, may sometimes cause anxiety. The frequency of the condition, as estimated by Noble¹ in 2274 cases, is 4·7 per cent ; but this figure is probably high. The local and general symptoms usually subside in a few days, but surgical intervention is sometimes necessary, and the results of this are uniformly good.

Sarcomatous change in a fibroid, according to Noble,¹ occurs in about 1·5 per cent of all the tumours removed by operation, but is less frequent if all the cases are taken into account. In calcareous degeneration there is an actual shrinkage of the tumour, and therefore a relief from symptoms may often be expected.

In general it may be said that the liability to symptoms arising from degenerative changes are in direct ratio to the size of the tumour and the relative youth of the patient.

3. *The chances of the menstrual loss becoming excessive* depend almost entirely on the situation of the tumour. Subperitoneal fibroids, because they do not encroach on the uterine cavity, have but little tendency this way. Even, however, when the tumour felt is obviously in this situation, it is impossible to exclude the chance of some smaller tumour being present more nearly in relation with the endometrium. Indeed, since it is rare to find a single tumour, it may be argued that where one large mass can be felt—whatever its position—it is pretty certain that one or more other tumours exist, too small for recognition, but which, by their possibility of subsequent growth, render the supervention of menorrhagia not unlikely, although at the moment no such symptom may be present. The hæmorrhage due to a fibroid is rarely directly fatal nowadays, because the case comes to operation before such a disaster has time to occur. It does occasionally still happen, however.

Indirectly, the severe menorrhagia is responsible not only for many of the fatalities, but also for many of the tardy convalescences, that follow operation. The intense anæmia induces a generally enfeebled state of the tissues, and particularly of the heart muscle, with consequent cardiac dilatation. It is amongst this class of patients that most of the deaths following the removal of fibroids are found, the fatal result being due to exhaustion, sudden cardiac failure, or pulmonary embolism. Further, the anæmic state of the patient tends to favour the occurrence of post-operative venous thrombosis, with its attendant risk of pulmonary embolism. Post-operative femoral thrombosis, apart from the risk of pulmonary embolism, delays recovery for from six weeks to three months. The left leg is the one usually affected.

4. *Extrusion of a fibroid* may take place in one of two ways. In the first, a submucous tumour practically becomes polypoid and is pushed through the cervix, a process associated with smart hæmorrhage and sometimes with pain. In the second, a sessile submucous tumour becomes inflamed and sloughs, the capsule of endometrium covering it gives way, and the mass, often in a pultaceous and stinking condition, is forced out of the uterus. This process is one associated with symptoms of more or less acute sepsis, and is one of considerable danger. The liability to these happenings is obviously dependent upon the situation of the tumour in the first instance. Further, they are comparatively rare below

forty years of age. The consequences are hæmorrhage and septic absorption; but the chief danger arises when such tumours are removed by the abdomen, when the chance of infecting the peritoneum is serious.

5. *The chances of inflammatory changes*—or changes leading to inflammation—taking place in or around the tumour are definite, for in a considerable proportion of the cases operated on such an event has occurred. Thus, salpingitis is quite commonly found, usually of the sclerotic or hydrosalpingitic variety, but occasionally the tubes contain pus. Another not uncommon condition to find is hæmatosalpinx, usually on both sides. The liability to salpingitis is increased if the patient has undergone intra-uterine treatment, such as curettage, electrolysis, ionization, and so forth, and also if pregnancy occurs, since fibroids increase the chances of sepsis during the puerperium.

Pedunculated fibroids may undergo axial rotation, but this is a much less common event than is the case with ovarian cysts.

6. *The chances of pressure symptoms* developing depend upon the situation of the tumour. When it is low down, and especially when it is growing from the supravaginal cervix, such symptoms are very common; when it is situated in the upper part of the uterus they are less likely.

Many patients with fibroids in the uterus experience more or less frequency of micturition. Cervical fibroids, if impacted in the pelvis, cause retention of urine. Similarly, a fundal tumour may cause the uterus to retrovert and become fixed under the promontory, with a like result. The ureters, strangely enough, are rarely pressed upon.

Acute intestinal obstruction may be caused by a fibroid—rarely by simple impaction in the pelvis, much more commonly by inflammatory adhesions.

7. *The association of carcinoma of the uterus with fibroids*.—The exact degree of risk that a patient runs in this connection is impossible to estimate, and it must be remembered that corporeal carcinoma is not a common disease under any circumstances. Cullen in 1400 cases found cancer of the body of the uterus in 1·7 per cent; Noble, in a large series of cases, found it in 2·5 per cent. It cannot be said that one growth predisposes to the development of the other, though operation statistics alone seem to favour this view. But the *coincidence* of cancer and fibroids is of great clinical importance; its possibility should always be borne in mind when the regular periodic hæmorrhage of a fibroid uterus begins to give place to irregular or constant loss.

Carcinoma of the cervix is rarely (0·7 per cent of all cases) associated with fibromyomata, since the latter are common in sterile women and the former is more particularly associated with fertility.

8. *With regard to pregnancy and labour*, the question of fertility in relation to fibroids constantly calls for decision. These tumours are frequently associated with sterility. Findley² states that 30 per cent of myomatous women are sterile, as opposed to a 10 per cent rate for the female population in general. The sterility may be due to the fibroid itself obstructing the meeting of sperm and germ, or to some endometrial change.

If conception occurs, there is an increased chance of miscarriage, but not to the extent that might be thought, because in such cases the fibroids are often subperitoneal in position and do not interfere with the uterine development.

Pregnancy causes an increase in size of the fibroid tumour. There is also an increased liability of the tumour to undergo degeneration and softening. Allusion has already been made to the frequent association of 'red degeneration', which, however, seldom requires surgical treatment.

The risks during labour depend on the situation of the tumour—masses low down will obstruct delivery and necessitate surgical measures, but when superficial and growing from the upper part of the uterus no ill-results may follow. There is, however, an increased risk of post-partum hæmorrhage in all cases.

During the puerperium a fibroid may inflame, necrose, or be extruded. These events are fraught with grave risks to the patient. If in the course of a difficult delivery the tumour has been bruised, septic necrosis is likely to follow.

It will thus be seen that the possession of a fibroid tumour very definitely increases the risks of child-bearing. On the other hand, the various complications that may arise in the course of pregnancy, labour, and the puerperium can in most cases be foreseen or at all events watched for, and if treated early can be successfully avoided.

II.—PROGNOSIS IN RELATION TO TREATMENT.

Operative Treatment.—This is the course to be advised in the vast majority of fibroids giving rise to symptoms, for not only is it the only certain method of cure, but it is also the quickest, and in the long run the least expensive.

Abdominal hysterectomy will be first of all referred to. The surgery of these tumours has been so greatly improved of recent years that the average mortality of the most radical procedure—hysterectomy—is probably not much over 1 per cent in expert hands, no greater, in fact, than that of appendicectomy in the quiescent period.

Each case must, however, be considered on its own merits. Hysterectomy is, in many cases, a perfectly straightforward operation, one that may be performed 'by the book' even by an operator of very little experience. But, on the other hand, it may be an extremely formidable undertaking, in which the question as to whether an expert or a tyro is to perform it makes all the difference in the prognosis. No one who is not fully competent to carry through successfully the most difficult case should undertake this class of surgery at all, for it is often impossible to gauge beforehand the degree of difficulty that will be met with.

The operation of subtotal hysterectomy—the cervix being left behind—is the one most generally applicable to cases of fibroids. It is considerably easier than the total operation, especially in the more complicated cases, and if the cervix is healthy there is no good reason to remove it.

The total operation should be reserved for special cases where the cervix is unhealthy, the uterus above it carcinomatous, or where vaginal drainage is desired.

In either operation the ovaries should be conserved if they are healthy; or, if this is not possible, then one, or at least part of one, should be left behind. The ovarian function continues unimpaired after hysterectomy, and in this regard the patient is no worse off than other women.

Patients often ask what effect removal of the uterus will have on their nervous system and upon sex feelings and intercourse in particular. The answer is that the operation leaves them in this respect unaltered. Child-bearing is of course impossible, but with this restriction marriage is able to be entered upon without any drawback.

The risks of the operation are of course increased if the fibroid be complicated by one or other of the superposed conditions that have been referred to. Of these, septic infection and necrosis are the most dangerous.

In the case of a patient very ill with a fibroid tumour, the objection to an operation is frequently made that she is too weak to undergo it. The reply is that she will not get stronger by waiting, and that the difficulties of the operation will certainly increase.

In conclusion, as illustrative of the results of hysterectomy, we quote the returns for 1912 and 1913 of the Chelsea Hospital for Women,³ representing all the cases operated upon by the various members of the staff:—

Total hysterectomy for myomata: 21 cases, no deaths. Subtotal hysterectomy for fibroids (with or without complications such as diseased appendage or appendages, ovarian cysts, etc.): 203 cases, 1 death. A. E. Giles⁴ has collected the results of abdominal hysterectomy for fibroids from twelve London hospitals for the five-year period 1909–13; the number of cases was 2741, and the mortality was 2·1 per cent.

These figures represent the result in expert hands under good conditions. They are therefore good; but they are the results of operations by all the members of the staffs, and may in consequence be taken as an index of what is easily realizable.

Myomectomy, with the conservation of the uterus, offers an alternative treatment in certain instances. The object is to allow if possible for the supervention of pregnancy, and to maintain the menstrual function. With regard to the latter point it may be said that, as in many cases of myomata the patient seeks treatment from the surgeon for the cure of excessive menstrual loss, myomectomy in some instances does not offer a complete cure, because the operation leaves behind a much hypertrophied uterus from which a continuance of the menorrhagic symptoms is possible. The prospects of future pregnancy would not appear to be great, as it is generally believed that not more than 10 per cent of these patients subsequently conceive. Reliable statistics are, however, unknown to us.

But myomectomy is coming more and more into favour as an alternative to hysterectomy. The fact remains, however, that myomectomy is limited to special cases where

tumours are not abundant, where menorrhagia is not marked, and where the patient is still of the child-bearing age.

The mortality in expert hands is low. W. Mayo⁵ reports 1 death in 157 cases of myomectomy in the last decade.

Vaginal operations are sometimes called for. Vaginal hysterectomy is now seldom employed; no radical operation by this route is advisable. The removal of a fibroid polypus or of a small accessible submucous fibroid is a simple procedure without risk. Large tumours are sometimes best removed in this way, especially sloughing submucous fibroids, for in such cases the profound sepsis makes an abdominal operation undesirable if it can be avoided.

Curettage as a cure for fibroid menorrhagia is not to be commended. It carries with it a definite risk of infection of the tumour, and in any case its effect is merely temporary.

Irradiation.—During the last few years many cases of fibroids have been treated by α rays or by radium, and good results have been obtained; but sufficient time has not elapsed to prove their permanence.

There are certain classes of cases in which such treatment is absolutely contra-indicated—namely, where the nature of the tumour suspected of being a fibroid is not certainly known, where inflammatory signs, or signs of incipient malignant disease, are present, and where urgent symptoms due to pressure or degeneration have declared themselves.

No patient under thirty-nine years should be submitted to Röntgen therapy; the nearer the menopause the more satisfactory is the result likely to be. The raying of fibroids in women who have ceased to menstruate for any length of time is of doubtful utility. The younger the patient, the more prolonged will be the treatment and the greater the liability to recurrence of hæmorrhage. The interstitial fibroid is the one most amenable to treatment; the subperitoneal pedunculated fibroid and the submucous polypus contra-indicate Röntgen therapy. Large tumours, reaching up to above the umbilicus, are also unsuitable. Amongst disadvantages which may be mentioned are the danger of skin-burns (not likely with modern technique), the length of time taken to effect a cure (three or four months), and the absence of knowledge of *possible* remote effects.

Irradiation seems to act by destroying the function of the ovaries and inducing a premature menopause, with its attendant train of symptoms. Though menorrhagia is cured in many of the cases, and the tumour made to shrink in a lesser proportion, absolute disappearance of the mass does not occur. The patient, therefore, cannot be considered as cured.

In the light of our present knowledge, therefore, the treatment by irradiation must be considered quite inferior to the surgical removal of the tumour.

Having regard to the interest now attaching to this form of treatment, it will be well to give some figures of results taken from recent literature of the subject.

As regards α rays, Birdsall⁶ quotes the following statistics collected by Holding: Of 667 cases, 56 per cent were considered cured, 31 per cent improved, 11 per cent unimproved, and 2.03 per cent died. Marck⁷ gives the following figures: Of 16 cases, 9 were cured, or 56 per cent; 4 were better, or 25 per cent; 3 were unimproved, or 19 per cent; only in 3 cases was a diminution in volume recognized.

As regards radium, Kelly and Burnam⁸ treated 21 cases in this way: in 2 the tumours disappeared, while the menstrual periods persisted regularly; in 1 the treatment failed, and operation was undertaken; in 1 inflammation occurred, and an abscess formed; in 6 the tumour apparently disappeared; and in 13 the tumour was reduced in size. They report a later series of 210 cases⁹ in which in nearly every case shrinkage of the tumour followed in from two to eighteen months.

Palliative and Expectant Treatment.—This is based on the chance of the tumour shrinking in size and ceasing to give rise to symptoms after the menopause. The likelihood is shown to be much less than was formerly supposed.

Fibroids prolong menstrual life, and the menopause is frequently not attained till the patient is well over fifty. After the cessation of the periods, the tumour does slowly shrink in a fair proportion of cases; but in others it continues to grow, or remains stationary. So long as it is present, the possibility remains of some complication supervening, and operations on elderly women have commonly to be performed on this account.

The period of the menopause and after would indeed appear to be that in which degeneration, inflammation, and malignant change are most common.

REFERENCES.—¹*Jour. Amer. Med. Assoc.* 1906, Dec. 8; ²Findley, *Diseases of Women*, 1914, 586; ³Chelsea Hospital for Women, 42nd and 43rd *Annual Reports*; ⁴*New System of Gynecology* (Eden), 1917, iii. 506; ⁵*Surg. Gynecol. and Obst.* 1911, Feb.; ⁶*Med. Rec.* 1914, May, 892; ⁷*Wien. klin. Woch.* 1914, May, 745; ⁸*Jour. Amer. Med. Assoc.* 1914, Aug. 22; ⁹*Trans. Amer. Gyn. Soc.* 1918, 317.

Bryden Glendining.
(Revised by Eardley Holland.)

UTERUS, RUPTURE OF.—The outlook in rupture of the uterus must still be regarded as very serious, as less than one in four cases recovers at the present day. Recent figures, however, show a vast improvement in results, the mortality being reduced by half, and this improvement is largely due to the adoption of operative rather than expectant treatment.

It is important to bear in mind that, although the gravity of uterine rupture is thought to be due to the ensuing hæmorrhage, yet it is rarely that such hæmorrhage is sufficient to cause immediate death. In at least 50 per cent of cases a dangerous hæmorrhage occurs, but it is not necessarily fatal. Thus the majority of deaths occur between three and twelve hours after the time of rupture—when the shock has to some degree passed off and further oozing occurs. Hæmorrhage proved fatal in 42·8 per cent of the cases occurring in the Moscow Maternity Hospital in a series collected by Ivanoff.¹

On the other hand, the part played by septic infection in these cases is very considerable; it is estimated that 37 per cent, or according to Eden² 50 per cent, succumb from this cause. It is thus seen that hæmorrhage and sepsis are much more serious than shock, which accounts for a small number of deaths.

Although the tendency of the present day is to ignore to some extent the division into complete and incomplete rupture of the uterus as regards method of treatment, yet it will be well to retain the grouping when considering the prognosis.

Incomplete Rupture.—The prognosis is influenced by: (1) The extent of the rupture; (2) The conditions under which it has occurred.

1. *The Extent of the Rupture.*—Ruptures involving only the lower segment present a much better outlook, in that the hæmorrhage is readily controlled by packing, and there is no risk of internal bleeding. The chances of septic complications are also considerably less. On the other hand, where the rupture extends well up the uterus to the peritoneal reflection, the condition is, speaking generally, just as serious as in the complete variety, and the prognosis differs little from what obtains in that condition, except that direct peritoneal infection is excluded. The hæmorrhage in these cases is often subperitoneal as well as external, and has been known to extend extraperitoneally as high as the kidney. When the rupture opens widely into the broad ligament, large branches of the uterine vessels are often torn; in such cases a huge palpable hæmatoma may form between the layers of the broad ligament, tending to burrow in all directions. Klein³ collected 30 cases in which extraperitoneal hæmorrhage occurred in this way, with a mortality of 70 per cent.

In many of the more extensive ruptures of the uterus it has been found that considerable difficulty was experienced in recognizing, by digital examination, whether the peritoneum was actually torn or not.

2. *Conditions under which Rupture Occurs.*—These are important in many ways. For instance, rupture of the uterus frequently occurs while turning the child for some malpresentation, such as a prolapsed arm. In this instance the presenting part will have been returned to the uterus, and the operator's hand will also have been introduced—under such circumstances it is difficult to exclude the risk of sepsis.

Again, in cases where rupture is spontaneous, which is rare in the slighter incomplete forms, the outlook is good once the hæmorrhage has stopped. In these cases equally good results are claimed both by those who favour douching with drainage, and by those who insist that packing with gauze is essential.

Complete Rupture and Large Incomplete Ruptures.—The factors which enter into consideration in these cases are somewhat different, and may be considered under the following headings: (1) The amount of hæmorrhage; (2) The facilities for operative procedure; (3) The treatment adopted.

1. *The Amount of Hæmorrhage.*—This must to a large extent be judged by the condition of the patient. It is to be remembered that the bleeding is almost entirely intraperitoneal—except in the incomplete variety, where it is largely extraperitoneal. A factor which seriously complicates the problem in these cases is the estimation of the accompanying shock. It will be found that blanching is of more value as an indication of the amount of hæmorrhage than the actual state of the pulse. The most reliable information is to be gained from a consideration of the condition of affairs in the pelvis. In a uterus from which both the foetus and the placenta are delivered, either externally or into the peritoneal cavity, and which has contracted down firmly, the amount of bleeding is not immediately dangerous. On the other hand, in a uterus still occupied by the placenta, the hæmorrhage must always be serious; it is to be remembered that the more serious bleeding is the secondary hæmorrhage or oozing that takes place as shock passes off. Some idea of the effect of hæmorrhage is seen in Ivanoff's series of 124 cases in the Moscow Maternity Hospital, where hæmorrhage proved fatal in 42·8 per cent; while in the Bucharest Hospital it was fatal in 24 per cent.

2. *The Facilities for Operative Procedure.*—While there is a certain number of cases in which the hæmorrhage is rapidly fatal, yet, if in the remainder effective surgical measures could be adopted within a short time, the mortality would be considerably reduced. The necessity in the majority of cases of waiting until operation can be undertaken, or of transport to a hospital, has in many instances been disastrous.

Further, while to the experienced gynæcologist there is nothing inherently difficult in the operative treatment of rupture, to any one not so practised the altered relationships of the parturient uterus increase considerably the operative risks, both by reason of the possible damage to the neighbouring structures and by the time lost in orientation. Therefore the absence of operative facilities and of an experienced obstetric surgeon militate against the chance of recovery.

3. *The Treatment Adopted.*—The results of operative treatment are so very much better than those of any expectant method, that the latter can only be justified in exceptional circumstances. Of operative procedures, the question resolves itself into deciding whether the better results are to be obtained by securing the bleeding point and repairing the rent, or by hysterectomy. It would be thought that the simpler procedure would give the better results; but when it is remembered that somewhere about 45 per cent of cases die of sepsis, the risks that are run in leaving the infected uterus behind are considerable. A more remote effect is sometimes seen in the subsequent history—the liability to a second rupture. Tarnier⁴ has collected 15 cases in which a second rupture occurred, with a mortality of 33 per cent. Again, it has happened in a few instances that, owing to difficulty in suturing the rupture, further bleeding has been possible. On the other hand, in a perfectly clean case where fertility is desired and the conditions are favourable, the simple repair of the rent offers a very good prognosis.

However, hysterectomy, and especially abdominal hysterectomy, will offer the best chance in the majority of cases. Its efficacy, the direct control of hæmorrhage which is obtained, and the elimination to a great extent of serious septic complications, outweigh the loss of the uterus and the slightly greater shock in most cases. Vaginal hysterectomy has not been performed extensively, but Kolomenkin⁵ has collected 3 cases with 1 death, and Klein³ 7 cases with 4 deaths.

In conclusion, we give a few general figures:—

Some of the most reliable are those collected by Kolomenkin,⁵ which represent cases treated in special institutes only—where the conditions may be said to have been most favourable. Of 140 cases, 97 were treated conservatively, with a mortality of 61 per cent; 33 were treated by hysterectomy, with a mortality of 36 per cent.

Tarnier⁴ between 1885 and 1897 treated 11 cases by packing, douching, etc.: 10 died. Between 1897 and 1902 he treated 12 cases: 6 died before operation could be done, 3 died after operation, 3 recovered.

Blacker⁶ treated 8 cases: 3 were operated on—all recovered; 2 did not admit of treatment—both died; 3 were plugged with gauze—2 died, 1 recovered.

REFERENCES.—¹*Ann. de Gynéc. et d'Obst.* 1904, lxi, 449; ²*Proc. Roy. Soc. Med. (Obst. and Gyn. Sect.)*, 1909, May; ³*Arch. f. Gynäkol.* 1901, lxii, 2; ⁴*Ann. de Gynéc. et d'Obst.* 1901, 249; ⁵*Monats. f. Geburtsh. u. Gynäcol.* 1903, xvii, 345; ⁶*Lancet*, 1912, Jan. 13. Bryden Glendining.
(Revised by Eardley Holland.)

VARICELLA.—(See CHICKEN-POX.)

VARICOCELE.—This anatomical defect is extremely common in young men, and the great majority of them never suffer any inconvenience from it. In a small proportion, however, it causes aching pain which may be quite severe. Many patients are very apprehensive that it will lead to sexual disability or other ill effects, and it appears to be true that the testis on that side may be smaller and softer than the other, but it is practically unknown for any interference with function to result. Except in rare cases of malignant growth of the left kidney region leading to the development of a varicocele, which is, of course, of ill omen under such circumstances, it is unusual to meet with men over forty getting any trouble from the venous dilatation, and in old men the condition is practically never seen, so that we may take it that varicocele retrogresses after the prime of life has been passed.

It used to be customary to reject candidates for the services if they suffered from varicocele, from fear of future disability owing to real or pretended pain; but if it has given no trouble before twenty-five, it is not likely to do so afterwards.

The operation of ligature and removal of the veins for this ailment is, of course, entirely trifling as far as the immediate mortality is concerned; this must be far below 1 per cent. But it is by no means so certain that real benefit will be obtained. Corner and Nitch¹ examined, at considerable periods after the operation, a hundred cases of varicocele. They found that in nearly one-fifth there was still some pain, and that 4 per cent of the patients were actually worse after this treatment, in that they now had symptoms where previously there had been none. The following table sums up the results:—

A HUNDRED CASES OF VARICOCELE EXAMINED SUBSEQUENTLY.

Testis harder -	90	Tense hydrocele -	8	Varicocele recurred	2
„ enlarged	55	Flaccid hydrocele	15	Cured or improved	70
„ smaller	21	Spermatocele	2	*Neither better nor	
Scrotum thick	50	Pain in testis	14	worse	26
		Pain in scar	5	*Worse	4

* Operated on to enter the services; free from symptoms before operation.

Even the above table does not quite complete the list of unfortunate consequences. The writer has seen or conversed with two patients operated on by various surgeons, in whom so many vessels were taken away that the testis became gangrenous and had to be removed. Suppuration occasionally occurs.

Douglas reports on 106 United States soldiers operated on for varicocele, and examined some time after. As many as 35 per cent had developed a small hydrocele, and in 4 cases the testis was somewhat atrophic.

Of 36 cases followed up from one to five years at the New York Hospital by Gibson, only one was unsatisfactory (cellulitis of scrotum).

We conclude, therefore, that operation should only be recommended for varicocele when it is genuinely a nuisance to the patient by causing pain which a suspensory bandage is not sufficient to relieve, and that, in operating, care should be taken to leave the testis an adequate blood-supply.

REFERENCES.—¹Corner and Nitch, *Brit. Med. Jour.* 1906, i, 191; Gibson, *Trans. Assoc. Amer. Surg.* 1919; Douglas, *Jour. Amer. Med. Assoc.* 1921, March 21.

A. Rendle Short.

VARICOSE VEINS.—It is almost too well known to require comment that, in addition to the aching pain so often complained of, varicose veins may also lead to ulceration, eczema, rupture, or thrombosis. In rare cases, a fatal result may follow from hæmorrhage, or pulmonary embolism after thrombosis. There is no tendency to natural cure, except that the varicose veins of pregnancy improve very much after delivery. Thrombosis may leave the leg permanently œdematous.

It is difficult to estimate the probability of fatal embolism after thrombosis of a vein in the leg, but typical cases are relatively infrequent, and the risk is less than 1 per

cent if the patient takes proper precautions. The greatest danger is after the first week, when the clot is gelatinous, and before the fourth, when it is fibrotic and adherent. Massage and movements increase the risk.

There are three well-recognized methods of operation for this condition : (1) *Removal and ligature vein by vein*. (2) *Trendelenburg's operation*, division and ligature of the saphena vein in the groin. (3) *Schede's operation*, a circumferential cut being made wholly or partly round the leg just below the knee, and all the veins divided and tied.

1. Removal and Ligature Vein by Vein.—The objection to the first method is that it is a long and tedious operation if the veins are numerous. The result, for the years immediately following, depends entirely upon the thoroughness of the surgeon. Many of the cases get into trouble again, after seven to ten years, from the development of a further crop of veins, and this in spite of combining the removal with a Trendelenburg ligature. It is not common, however, for the patient to need a second operation. Jaennel, in his report to the French Congress of Surgery in 1910, found complete cure in patients followed from a few months to ten years in 52 out of 70 cases, that is, 74 per cent. When the whole saphena vein in thigh and leg was removed, 73 out of 77 (95 per cent) were cured. The follow-up system at the New York Hospital showed 2 cases unsatisfactory out of 32 in which the patient was seen at intervals of one to five years after operation. The other 30 were satisfactory.

2. Trendelenburg's Operation.—It is possible to obtain more definite evidence of the effects of this operation—and of Schede's—proceeding, as they do, upon a more stereotyped plan. Goerlich¹ has made a personal study of 69 cases operated on by the Trendelenburg method in von Bruns' clinic ; of these, 84 per cent were cured as far as symptoms were concerned, but only 27 per cent were free from varices. In 47 cases the saphena vein had been restored, in spite of division and ligature. He also collected the results of 1425 literature cases, with cures in from 56 to 85 per cent. Miller² followed, for periods of from six months to ten years, 41 cases operated on by the same method in Halsted's clinic. The patients were pretty equally distributed over the various years. Of 19 cases followed 1 to 4 years, 89 per cent were cured ; of 19 cases followed 5 to 8 years, 63 per cent were cured. This shows the danger of late return of the trouble. Jaennel reported only 56 per cent cured out of 697 cases treated by the Trendelenburg operation, and followed from two months to twelve years. When this was combined with removal of the prominent varices, 60 per cent out of 95 patients, followed up to fourteen years, were cured. It is probable, however, that the worst type of cases were treated by this method.

3. Schede's Operation.—The results of this operation were much less satisfactory, though the evidence was slender. Only 3 out of 9 patients were cured, and two of these were quite recent. Oedema of the leg followed several times. It was interesting to find that the veins, in spite of division and ligature, reunited ; photographs show them running right across the incisional scar, and a vein dissected out still displayed the mark of the ligature upon it.

The principal danger of surgical treatment is pulmonary embolism, of which a fair number of cases have been reported ; but long series, comprising several hundreds of operations, have been recorded in which this cause of death does not figure ; it must be quite rare.

We conclude, then, that the best results are given by total removal of the saphena vein in the thigh and leg ; that multiple resection vein by vein, with Trendelenburg ligature, takes second place ; that the Trendelenburg ligature alone comes next ; and that Schede's operation is not satisfactory.

REFERENCES. —¹Goerlich, *Beitr. z. klin. Chir.* xliv, 278 ; ²Miller, *Johns Hop. Hosp. Bull.* 1906, xvii, 289.

A. Rendle Short.

VISCERA, ABDOMINAL, INJURIES OF.—(See ABDOMINAL INJURIES ; GUNSHOT WOUNDS.)

VOMITING OF PREGNANCY.—If all cases in which the vomiting of pregnancy is excessive and persistent be grouped together, the outlook becomes very favourable. The vast majority are 'neurotic' (or 'nervous', or 'hysterical') and react perfectly well

to simple treatment. Medical literature abounds in records of two or three cases successfully treated by some special medicament when all other means were apparently failing. At the present time these records relate to cases treated with injections of blood serum or *corpus luteum* extract. Previously, much success attended thyroid or suprarenal extract administration. The truth is, as noted above, that the vast majority are readily amenable to treatment, but there is a very small group—the toxæmic—which it is difficult to recognize, and which when inefficiently treated may suddenly prove fatal.

Whitridge Williams classifies cases into the following groups: (1) *The neurotic*—by far the most frequent; (2) *The toxæmic*—by far the rarest and most serious group; and (3) *The reflex*—an uncommon group, where the vomiting is supposed to be reflexly excited by some organic condition, such as a retroverted uterus. Underlying each of these is probably a chronic toxæmia—indicative of a failure of physiological adjustment between the maternal organism and the foetal sac.

The *toxæmic* group is very serious; fortunately, it is extremely rare. A case of toxæmic vomiting of pregnancy is really a case of the true toxæmia of pregnancy, occurring in the early instead of in the customary later months of pregnancy, and of which the vomiting is only one symptom; such a case should be called one of toxæmia of early pregnancy with severe vomiting. Hurst¹ denies the existence of the toxæmic group, and believes that pernicious vomiting of pregnancy is always hysterical. This is an extreme view, but there is no doubt that many severe cases of *neurotic* vomiting have been wrongly regarded as *toxæmic*, and have been needlessly treated by the induction of therapeutic abortion. It was believed until comparatively recently that the *toxæmic* type could be distinguished by estimating the ammonia index of the urine; an index exceeding 10, in a case of pernicious vomiting, was believed to be diagnostic of the *toxæmic* variety. But it is now recognized that a high index can occur in any case of severe vomiting, and is merely the result of starvation and dehydration. The diagnosis of toxæmic vomiting is only justified by the presence of albumin and tube-casts in the urine.

The *neurotic* type should react readily to simple treatment, such as complete rest in bed, isolation from usual surroundings and friends, a careful diet or rectal feeding and salines, and simple drugs—including sodium bicarbonate and glucose to overcome the acidosis which always aggravates the symptoms. Thus J. H. Martin treated 17 cases in the Glasgow Maternity Hospital by these means, with the result that 16 were cured. But no form of treatment is so successful in effecting a rapid and complete cure as psychotherapy. Hurst¹ and Oldfield² lay great emphasis on this, and record excellent illustrative examples of patients cured by simple methods of suggestion.

All the same, cases are occasionally met with in which the patient does not react to any form of therapeutic treatment, but goes steadily downhill. The chief problem in these cases lies in deciding when to interfere with the pregnancy. On the one hand, the natural desire is to allow the pregnancy to continue; on the other, emptying the uterus shows decidedly good results, provided it be not too long delayed. That the results in these exceptionally severe cases are not better is largely due to the tendency on the part of the obstetrician to try how long he can postpone evacuation of the uterus, often with disastrous results to the patient.

The clinical features which should be relied upon as indicating the prognosis or calling for more drastic treatment are the following:—

1. *The loss of weight* should not be allowed to exceed one-third of the total body-weight; this is, however, of little use when, as often happens, the initial weight is unknown.

2. The presence of albumin and tube-casts in the urine.

3. *The pulse* probably forms one of the best guides. Many authors advise emptying the uterus when the pulse-rate exceeds 100 per minute in cases which are being treated by absolute rest and low diet. Certain observers, however, insist that a pulse of even 120 is not by itself of grave import.

4. *The vomiting*, when persistent, and accompanied by wasting and a rise in temperature, is to be taken into account. Many cases cease vomiting toward the end, and what is often looked upon as an improvement is in reality an indication of approaching death.

5. *Delirium* and *diarrhœa* are indications of great danger.

In all true *toxæmic* cases, and in other cases which do not react to ordinary measures, little further time should be lost. If within thirty-six to forty-eight hours there is no

improvement, emptying of the uterus is indicated without delay. These patients are by this time in too feeble a condition to stand a large or prolonged operation; consequently, from the point of view of prognosis it is most important that a quick method should be employed. In early cases, it is best to dilate the cervix and empty the uterus at one sitting; in later cases, when great haste is demanded, anterior vaginal hysterectomy is the method of choice. Equally important, too, is the anæsthesia employed. The condition of acidosis, resulting from the starvation of vomiting, precludes absolutely the use of chloroform. Failing spinal anæsthesia, the best anæsthetic in such cases is a combination of gas and oxygen, but ether may be used where the former is for any reason not available. It too frequently happens that the emptying of the uterus has been successfully accomplished, but the patient dies from shock or from delayed chloroform poisoning.

REFERENCES.—¹Hurst, *Lancet*, 1922, March 18; ²Oldfield, *Jour. Obst. and Gynæcol. Brit. Emp.* 1922, xxix, No. 2, 303.

Bryden Glendining.

(Revised by Eardley Holland.)

VULVA, CARCINOMA OF.—The growth in the majority of cases is an epithelioma, and conforms to the character of such tumours in being comparatively slow-growing. Its superficial position ought also to lead to its early detection; but, unfortunately, the fact that the majority of malignant vulval growths are secondary to leucoplakia vulvæ has resulted in obscuring the onset of malignancy. In order to rectify this tendency, some surgeons insist that it is wise to regard leucoplakia vulvæ as in all respects comparable to leucoplakia of the tongue—that is, as a pre-cancerous state.

A distinction should be made between this group arising in leucoplakic conditions and mainly involving the labia, and that group arising in an otherwise healthy vulva and usually situated in the neighbourhood of the clitoris and urethra, for the former is more amenable to treatment.

The factors mainly influencing prognosis, and requiring more special consideration, are: (1) *The site of growth*; (2) *The stage of advancement when first seen*; and (3) *The treatment adopted*.

1. The Site of the Growth.—The growths of the vulva are readily divided into two groups. In the first place there is the smaller group arising in the vicinity of the clitoris, in a frænal fold, where it forms a small nodular mass covered with unaltered skin. The proximity of the growth, on the one hand to the bone, which limits the extent of resection, and on the other hand to the urethra, which is often preserved with undue risk of recurrence, both affect the prognosis adversely. Further, the rich lymphatic drain of this region promotes deposits in the inguinal glands of both sides.

The second and larger group comprises those arising in the labia; here the margin of tissue is a little greater. These cases generally develop in a pre-existing leucoplakia: and if all cases of leucoplakia vulvæ were regarded with the same suspicion as leucoplakia of the tongue, the chances of early detection and successful treatment of the developing epithelioma would be considerably enhanced. The growths in this region more frequently ulcerate, or show a roughly papillary surface, which renders their nature unmistakable owing to the clinical features.

2. The State of Advancement.—It is obvious that with a growth already down to the underlying bone, the chances of complete eradication are small.

In judging of the gravity of the case, the state of the inguinal glands should be considered. Enlargement of the inguinal group, especially if slight, is by no means an indication of secondary deposits, but is to be regarded as an index of septic absorption until the presence of new growth has been demonstrated microscopically. Considerable enlargement, however, does as a rule indicate malignant deposit; but even in these cases, radical operation offers the best chance of a cure.

3. The Treatment Adopted.—Operative procedure in which a wide area surrounding the growth, and also the whole tract of lymphatic drainage, including the inguinal group of glands, are removed in one piece, will show better results than will purely circumscribed operations. Many operators, while widely resecting the region of growth, and also removing the inguinal lymph glands, yet leave the connecting lymphatic tracts, with disastrous results as to recurrence.

Again, if leucoplakia is regarded with due suspicion, and the earliest development of

malignant disease is countered by wide resection, results will be obtained showing great improvement on those of the present day.

When the growth has recurred, the application of *x*-rays and radium, and diathermic cauterization, offer chances of considerable relief from the distress of a fungating ulcerated mass, and in rare instances may even result in a cure. The application of *x* rays and radium is still of too recent a date to permit of the compilation of figures of results, but there is at present no question of the relief afforded in otherwise intractable conditions.

Bryden Glendining.
(Revised by Eardley Holland.)

WHOOPIING-COUGH.—The prognosis in this disease will be here considered under the following heads: (1) *Age*; (2) *Sex*; (3) *Complications*; (4) *Special symptoms*; (5) *Physical and social conditions*; (6) *Season*.

1. **Age.**—The Aberdeen figures furnish us with the most trustworthy information on this point. Whooping-cough was made a notifiable disease in that city for the twenty years 1882 to 1900, and details have been published which give the age incidence of the cases and deaths for the last ten years of that period. During those ten years there were 15,093 cases, with 722 deaths, a mortality of 4·7 per cent. The following shows the fatality at the various ages up to five years:—

Under 1	-	12·5 per cent	4 to 5	-	1·6 per cent
1 to 2	-	10·1 „	Over 5	-	Under 1·0 „
2 to 3	-	3·5 „	„ 7	-	Practically nil
3 to 4	-	2·2 „			

From these figures it follows that whooping-cough is a disease of considerable danger to infants and children under two years; but after that age it becomes much less serious.

Cases treated in hospital show a much higher fatality, because it is the most serious ones which are sent to hospital for treatment. But the same relative severity of the disease according to age still appears in hospital-treated cases, as is shown by the following table, which gives the numbers of cases and deaths in the Metropolitan Asylums Board Hospitals for the four years 1911 to 1914:—

FATALITY ACCORDING TO AGE (METROPOLITAN ASYLUMS BOARD).

Age	Cases	Deaths	Fatality per cent
Under 1	672	165	24·5
1-2	1220	202	16·5
2-3	929	78	8·3
3-4	712	39	5·4
4-5	529	16	3·0
Under 5	4062	500	12·3
5-10	604	14	2·3
10-15	26	0	0·0
15 & over	3	0	0·0
Total	4695	514	10·9

2. **Sex.**—The Aberdeen figures show that the fatality in this respect, for all ages, was the same, 4·7 per cent; and that amongst the patients over six years of age there were no deaths amongst the males, though there were several amongst the females.

3. **Complications.**—In whooping-cough death is much more often due to some complication than to the virulence of the disease itself. Of these complications the most formidable is *bronchopneumonia*. It occurs in about 13 per cent of cases treated in hospital, and from 25 to 50 per cent of those so affected die.

Convulsions are also extremely serious. According to the returns of the Metropolitan

Asylums Board, they are met with in 2 per cent of the cases. Convulsions are most grave when they occur apart from lung complications, and when they are repeated.

Otitis media arises in about 5 per cent of the cases.

Cerebral complications are fortunately uncommon. They are highly dangerous; and if not immediately fatal, they often lead to permanent impairment of the functions of some part of the nervous system.

4. Special Conditions.—As a rule the longer the duration of the catarrhal, the less severe is the paroxysmal stage. The severity of the latter chiefly depends upon the frequency and intensity of the paroxysms. The ability of the child to retain his food has a great influence. Frequent vomiting, which often goes with frequency of paroxysm, retards recovery, and may contribute to a fatal result.

5. Physical and Social Conditions.—Ill-fed, rickety, and tuberculous children are very bad subjects. Even in a normal child a severe attack of whooping-cough, especially if complicated with bronchopneumonia, may result in permanent thoracic deformity or chronic pulmonary disease; but such results are most likely to follow in the case of rickety patients.

Adenoids and enlarged tonsils often prolong the paroxysmal stage.

In the Aberdeen cases it was found that while the average fatality was 4·7 per cent, that of patients in families living in one room was 7·8 per cent; in those living in two rooms, 5 per cent; in three rooms, 4·5 per cent; in four rooms, 3·4 per cent; and in five or more, 2·2 per cent. This may be taken as evidence that the social state of the patient considerably affects his chances of recovery.

6. Season.—In Aberdeen it was found that the fatality was highest in the months of February, April, and May—the end of winter and the beginning of the spring (6·5 to 6·9 per cent). As in this disease death usually takes place somewhat late in its course, the onset of these fatal cases may be referred to the winter or the end of the autumn. On the other hand, the fatality was lowest in October and November (3·8 per cent); here the onset of the disease was during the autumn or in the late summer.

Whooping-cough, like most of the acute infectious diseases, varies considerably in its virulence from time to time. Thus, in Aberdeen the average fatality for the years 1882 to 1889 was 10·5 per cent; while for the years 1900 to 1910 it was 5·3 per cent.

E. W. Goodall.

WOUNDS, GUNSHOT.—(See GUNSHOT WOUNDS.)

YELLOW FEVER.—The mortality of yellow fever varies widely in different outbreaks, but the extensive figures of Bérenger-Féraud show it to average 40 to 45 per cent in the West Indies, on the Mexican Coast, and in West Africa, but to be only about 25 per cent in the United States, Brazil, and European countries. In mild types it is said occasionally to be as low as 10 per cent.

The severity in individual cases varies from extreme malignancy, causing death in the first two days before the characteristic third stage has developed, down to the mildest cases, in which the disease terminates favourably after two or three days without the development of the more typical symptoms, being consequently liable to be overlooked, although still capable of spreading the infection. In the third stage, beginning with the second rise of temperature after the temporary remission of the fever, the characteristic and serious symptoms appear. The most dangerous are copious albumin in the urine with diminution of the secretion, which may go on to suppression, always fatal if it persists for from fifteen to twenty-four hours; hæmorrhages, especially the dreaded black vomit and melæna or bleeding from the mouth; intermittent pulse, with tendency to sudden syncope; cyanosis; and coma. Recovery may, however, take place after an apparently desperate stage has been reached, and convalescence is often remarkably rapid. Sternberg's mixture of sodium bicarbonate and perchloride of mercury is said to reduce the mortality. Intravenous injections of sodium bicarbonate, as used successfully in threatening uræmia in cholera, are worthy of trial.

Leonard Rogers.

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